Piano Strutturale

Relazione geofisica

novembre 2023

Comune di Montevarchi

Piano Strutturale

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1. PREMESSA

Il presente rapporto riferisce i risultati ottenuti da un'indagine sismica condotta per la stesura delle carte di microzonazione sismica, ai fini della prevenzione sismica e della valutazione del rischio sismico del comune di Montevarchi (AR).

Le finalità della prospezione erano quelle di identificare e ricostruire, sulla base delle loro caratteristiche fisiche e meccaniche, i rapporti geometrici dei terreni presenti nel sottosuolo delle aree indagate, di fornire il valore Vs30 utile per la classificazione del terreno nelle varie categorie di suolo come prescritto dalla normativa antisismica e di individuare possibili fenomeni di risonanza sismica.

A tal scopo sono stati realizzati 14 profili sismici tomografici a rifrazione per determinare le variazioni della velocità delle onde di volume "P" e delle onde di taglio "S" nel sottosuolo. Inoltre, su altri 55 punti individuati, sono state effettuate delle misure HVSR con registrazione di microtremori per la misura del periodo e dell'ampiezza delle vibrazioni del suolo. Infine, sono state effettuati dei rilievi di superficie di tipo MASW e di tipo ESAC per la determinazione del valore Vs_{eq} di sito.

Il presente rapporto riferisce i risultati ottenuti dall'indagine sismica ed illustra le metodologie esecutive ed interpretative delle misure geofisiche, nonché i risultati della prospezione, secondo un criterio essenzialmente geofisico.

2. INDAGINI SVOLTE

La campagna di indagine è stata sviluppata in alcuni giorni dei mesi compresi tra Giugno e Agosto 2021.

Per ottenere i risultati attesi sono state realizzate prove sismiche distinte per la caratterizzazione di ogni singola area di studio. In particolare, sono stati utilizzate le seguenti metodologie:

- profilo sismico a rifrazione interpretato tomograficamente per determinare le variazioni della velocità delle onde di volume "P" e delle onde di taglio "S" nel sottosuolo;
- prova MASW (Multi-channel Analysis of Surface Waves) in corrispondenza dell'allineamento sismico, per ricostruire la successione stratigrafica secondo il parametro della velocità sismica delle onde di taglio "S";
- prova "ESAC" (Extended Spatial Auto - Correlation), per ricostruire la successione stratigrafica secondo il parametro della velocità sismica delle onde di taglio "S";
- misure HVSR o del rumore sismico ambientale per la determinazione della curva H/V.

L'ubicazione delle indagini è riportata sulla cartografia di base in scala 1:10.000 della Regione Toscana.

3. STRUMENTAZIONE IMPIEGATA

Per l'esecuzione delle prospezioni sono state utilizzate le seguenti strumentazioni ed attrezzature:

n°	Strumentazione Sismica per profili sismici tomografici e misure ReMi e MASW
1	Sismografo GEOMETRICS "GEODE" 24 ch - 24 bit
1	Computer portatile HP per registrazione dei dati di campagna
24	Geofoni verticali con frequenza pari a 4,5 Hz
24	Geofoni orizzontali con frequenza pari a 14,5 Hz
1	Cavo di collegamento per geofoni
1	Trigger dispositivo "hammer switch"
1	Massa battente del peso di 6,5 kg

n°	Strumentazione Sismica per misure HVSR
1	Dispositivo di registrazione Dymas SOLGEO
1	Dispositivo di acquisizione sismometro triassiale VELOGET SEISMOMETER

4. FINALITÀ DELLA PROSPEZIONE

Le finalità della prospezione geofisica possono così essere sinteticamente riassunte:

- ricostruzione di sezione sismo-stratigrafica secondo le onde sismiche di compressione P;
- ricostruzione di successione sismica stratigrafica secondo in funzione delle onde di taglio S.
- definizione del valore V_{seq} per la classificazione dei suoli di fondazione nelle categorie previste dalla normativa antisismica.
- definire la frequenza di risonanza dei terreni.

5. ESECUZIONE DEI RILIEVI

5.1 Profilo sismico tomografico a rifrazione onde "P"

Lo scopo della prova consiste nel determinare il profilo di rigidezza del sito attraverso la misura diretta della velocità di propagazione delle onde di compressione (Vp), secondo fasi d'acquisizione differenti e determinare le geometrie sepolte (spessori e superfici di contatto) dei sismostrati individuati.
La prova consiste nel produrre sulla superficie del terreno, in prossimità del sito da investigare, delle sollecitazioni dinamiche verticali per la generazione delle onde P e nel registrare le vibrazioni prodotte, sempre in corrispondenza della superficie, a distanze note e prefissate mediante sensori a componente verticale (geofoni). Di seguito si riporta lo schema dell'array sismico realizzato per la base da 24 geofoni utilizzati per lo svolgimento dell'indagine:

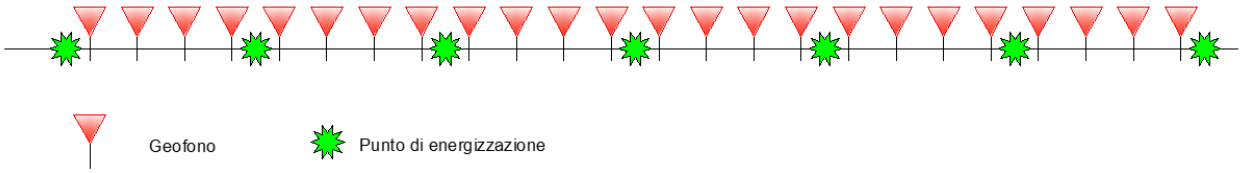


Figura 1: Rappresentazione schematica di array sismico a rifrazione

Come sistema energizzante per la generazione delle onde P è stata adottata una massa battente in grado di generare onde elastiche ad alta frequenza, con forme d'onda ripetibili, ovvero con la possibilità di ottenere prevalentemente onde di compressione.

Riassumendo il profilo sismico a rifrazione eseguito presenta le seguenti caratteristiche:

- Numero geofoni: 24;
- Spaziatura dei geofoni: 2,5 – 5,0 metri;
- Frequenza geofoni: 4,5 Hz;
- Spaziatura dei tiri: 10 – 20 metri;
- Sorgente: massa battente

5.2 Profilo sismico tomografico a rifrazione onde "SH"

Lo scopo della prova consiste nel determinare il profilo di rigidezza del sito attraverso la misura diretta della velocità di propagazione delle onde di taglio (Vs), secondo fasi d'acquisizione differenti e determinare le geometrie sepolte (spessori e superfici di contatto) dei sismostrati individuati.

La prova consiste nel produrre sulla superficie del terreno, in prossimità del sito da investigare, delle sollecitazioni dinamiche orizzontali per la generazione delle onde S_H e nel registrare le vibrazioni prodotte, sempre in corrispondenza della superficie, a distanze note e prefissate mediante sensori a componente orizzontale (geofoni).

In riferimento all'indagine geofisica di sismica a rifrazione con onde polarizzate S_H sono state adottate le seguenti caratteristiche:

- Numero geofoni: 24;
- Frequenza geofoni: 14 Hz;
- spaziatura dei geofoni: 2,5 – 5,0 metri;
- spaziatura dei punti di scoppio: 10 – 20 metri;
- Sorgente: massa battente.

Per quanto riguarda la generazione di onde polarizzate S_H si è proceduto, viste le condizioni di accessibilità del sito, ad energizzare con la duplice battuta orizzontale ed è avvenuta secondo la procedura seguente:

a) disposizione dei geofoni di tipo orizzontale lungo la linea, con il sensore (geofono) libero di vibrare lungo l'asse orizzontale ortogonale alla linea dello stendimento
b) posizionamento del sistema energizzante (piastra metallica e mazza) in modo da energizzare nel senso ortogonale all'allineamento geofonico
c) STACK1: energizzazione in un senso, definita convenzionalmente *battuta destra (dx)*, acquisita con polarità del sismografo *positiva*
d) cambio di polarità sul sismografo, da positiva a negativa
e) STACK2: energizzazione nel senso opposto al precedente (*battuta sinistra*)
f) acquisizione del file generato dalla somma dello STACK1+STACK2 – onde S_H polarizzate

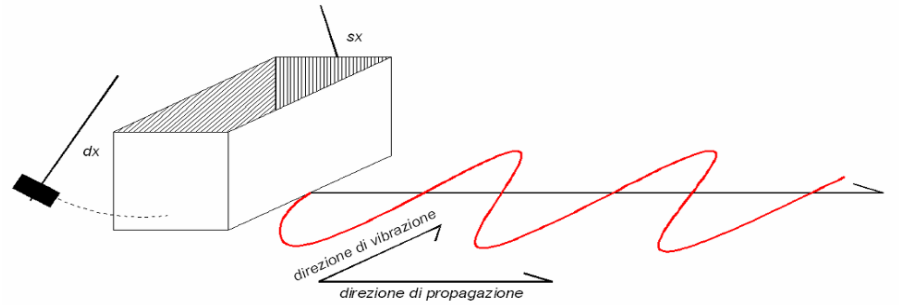


Figura 2: Schema per la generazione di onde polarizzate S_H e schema di avanzamento del fronte d'onda

Le indagini sismiche in sito hanno permesso di determinare direttamente la velocità di propagazione, all'interno del mezzo in esame, delle onde di compressione (onde "P") e delle onde di taglio (onde "S ") ed indirettamente, utilizzando i valori delle velocità acquisite, alcune proprietà meccaniche delle litologie investigate.

Nell'ambito degli studi geognostici delle litologie si è provveduto alla parametrizzazione dinamica dei terreni. Nello specifico sono state acquisite misure della velocità delle onde sismiche che hanno permesso di determinare la rigidezza iniziale (G0 o Gmax), ossia la rigidezza a livelli di deformazione molto bassi. Nell'indagine geofisica svolta tale parametrizzazione è stata ottenuta attraverso misure delle onde di compressione (P) e di taglio (S), mediante rilievi sismici di superficie.

Per quanto riguarda le principali proprietà dinamiche dei terreni, è opportuno ricordare che per sottosuoli naturali, a causa della rapidità delle azioni e del fatto che questi si trovano per gran parte sotto falda, ci si trova in condizioni di drenaggio impedito e pertanto il fenomeno sismico produce deformazioni volumetriche trascurabili, rispetto a quelle distorsionali. Per questo motivo appare giustificato ricondurre la modellazione meccanica di un fenomeno sismico all'analisi degli effetti prodotti da un insieme d'onde "S", che si propagano dal substrato alla superficie, con un campo di spostamenti del terreno in pratica orizzontale. Tale assunzione è oltretutto giustificata dal fatto che, da un punto di vista ingegneristico, il moto più verosimile ai fini della verifica sismica dei manufatti è quello orizzontale. In tal senso, a livelli di deformazione bassi, è assunta l'ipotesi che il terreno in esame presenti un comportamento tensione-deformazione di tipo elastico lineare (deformazioni inferiori a 10-3 %).

Le velocità delle onde P misurate per terreni perfettamente saturi (Sr = 100%) dipendono talora in maniera decisiva dalle vibrazioni trasmesse dal fluido interstiziale e non dallo scheletro solido del materiale e perciò tali valori possono non essere rappresentativi delle proprietà meccaniche del materiale in questione secondo le relazioni matematiche espresse in precedenza; invece le velocità delle onde "S" e delle onde di superficie, sono caratteristiche delle vibrazioni trasmesse prevalentemente dal solo scheletro solido e perciò rappresentative delle proprietà meccaniche del terreno. Ne consegue che per alcuni terreni sotto falda, le uniche onde in grado di fornire informazioni precise sulla rigidezza del terreno sono quelle di taglio e, subordinatamente, le onde di superficie.

Le onde elastiche si propagano nelle rocce con vari schemi e con diverse velocità. Secondo queste modalità le onde sismiche pertanto sono distinte in longitudinali, trasversali, superficiali (Stoneley, Love, Rayleigh, etc..).
Nelle varie applicazioni della sismica s'impiegano impulsi artificiali d'energizzazione che producono onde elastiche di diversi tipi; tra queste sono prese in esame solo le onde longitudinali o "prime" (P) e quelle trasversali o "seconde" (S).
Occorre ricordare che la componente dell'onda sismica compressionale (P) risulta più veloce dell'altra componente (S) e pertanto l'arrivo di queste onde di taglio deve essere ricercato all'interno del sismogramma registrato.
Le due onde, com'è noto, si differenziano per la diversa modalità di deformazione dei terreni durante la loro diffusione: la propagazione delle onde longitudinali avviene mediante compressioni e decompressioni delle rocce, mentre quella delle onde trasversali si basa sulla trasmissione di sforzi di taglio.

Nella prova sismica effettuata, i tempi di primo arrivo delle onde P ed S (Figura 3) sono stati letti e tabellati attraverso specifici programmi di picking che permettono di rimontare insieme le tracce relative alle varie profondità, per ciascun trasduttore, con precisione di lettura fino a 0,001 millisecondi

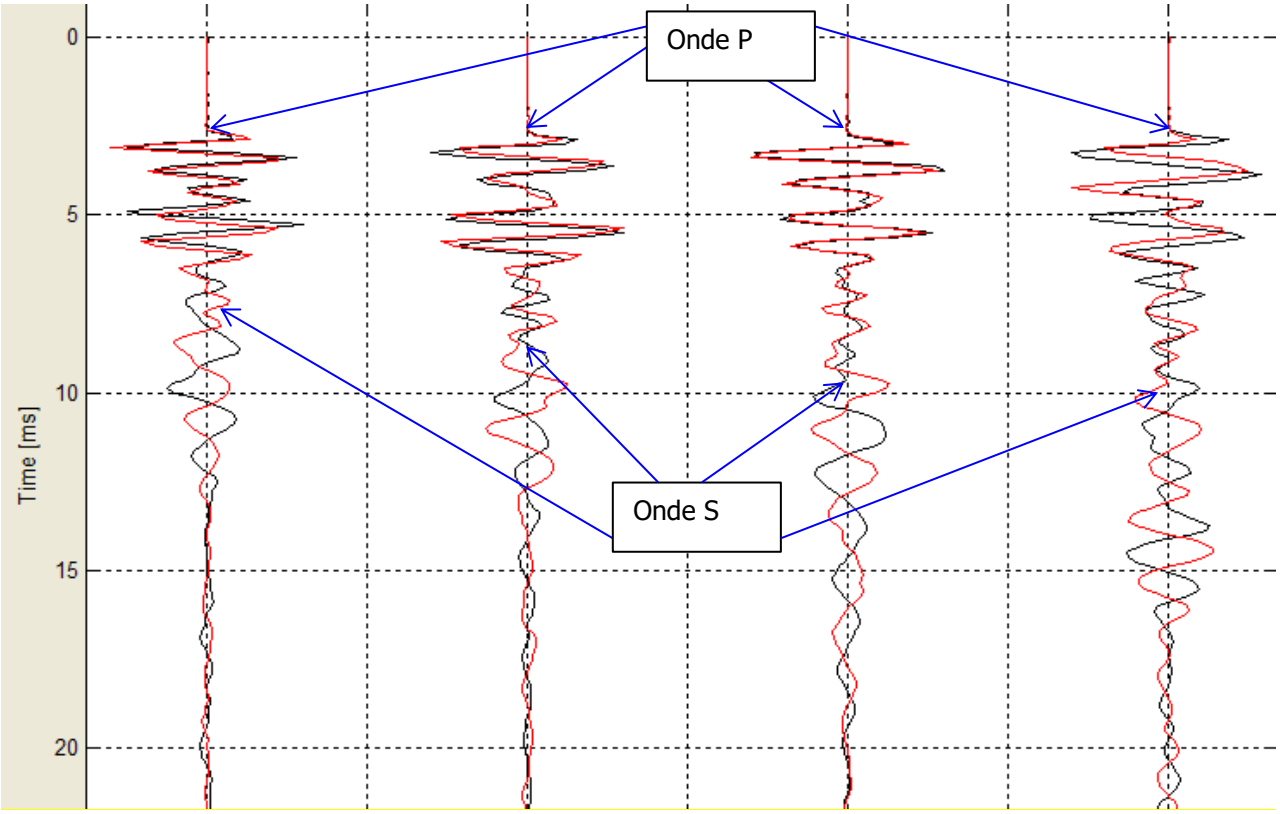


Figura 3: Sismogramma – Identificazione dei tempi onde P e onde S

I tempi di arrivo delle onde P e delle onde S misurate permettono in funzione della distanza, attraverso specifiche elaborazioni, di calcolare le velocità sismiche delle varie litologie incontrate alle diverse profondità.

La fase d'interpretazione dei dati acquisiti in campagna è stata preceduta dalla lettura dei tempi sismici registrati. Dai sismogrammi registrati con il rilievo sismico eseguito con le caratteristiche sopra citate si ricavano i tempi di "primo arrivo" dell'onda sismica. Tali tempi sono riportati nel grafico dromocrone presenti per ogni profilo sulle tavole allegate.

I tempi d'arrivo delle onde "P" e successivamente delle onde "S_h" sono stati letti attraverso uno specifico programma di picking ed in seguito tabellati. Dopo, per mezzo dello specifico programma *SeisOpt@Prov2.5*, è stata eseguita un'interpretazione con metodologia tomografica dei profili sismici.

I tempi sismici delle onde P e delle onde S_H sono stati elaborati con metodologia tomografica che prevede la suddivisione dello spazio bidimensionale in celle quadrate o rettangolari secondo una maglia prefissata, con l'attribuzione ad ognuna di un determinato valore di velocità sismica. Nell'elaborazione il programma di calcolo determina il tempo di transito ipotizzando dei valori di velocità sismica per ogni cella, tale processo cessa quando si raggiunge la minore discordanza tra i tempi calcolati e i tempi sismici sperimentali misurati sui sismogrammi.

Il modello sismico derivato da tale processo, detto inverso, permette di ottenere una sezione in due dimensioni che ci consente di poter effettuare una interpretazione per definire un assetto stratigrafico in base alla velocità sismica e al gradiente di velocità.

Una dettagliata descrizione dei fondamenti teorici della tomografia sismica è stata pubblicata da Nolet (1987). L'interpretazione dei dati, che viene sviluppata effettuando un'analisi di modellazione del sottosuolo su base anisotropia attraverso la suddivisione dello spazio in celle regolari, fornisce, previa elaborazione con tecniche di ricostruzione tomografica (ART, SIRT: Gilbert, 1972; Gordon, 1974; Miranda, 1989), il campo delle velocità sismiche del sottosuolo. Nel caso specifico per le sezioni tomografiche la scelta della dimensione delle celle è stata effettuata sulla base dei modelli interpretativi migliori. Per la determinazione di questi ultimi è stato utilizzato il metodo di inversione controllato "Monte Carlo" implementato su una modellizzazione avanzata, ove i modelli sono accettati o rifiutati basandosi su un criterio statistico.

L'accuratezza del modello inverso è definita dallo scarto quadratico medio calcolato tra i tempi di primo arrivo sperimentali ed i calcolati. Per ogni cella investigata è stato calcolato un valore di velocità sismica e per renderne più immediata la comprensione, alle stesse celle è stato attribuito un colore secondo una scala con tonalità prefissate.

5.3 Misure HVSR - Horizontal to Vertical Spectral Ratios

Il tipo di misura rientra nel campo delle indagini a sismica passiva, per la registrazione del rumore sismico ambientale. La prova consiste nel posizionare la strumentazione composta da una terna sismica secondo le componenti cartesiane allineate con i riferimenti geografici, e in modo da eliminare eventuali disturbi prodotti da sorgenti esterne locali. (vento, radici, vegetazione...). Successivamente viene realizzata la registrazione per un tempo relativamente lungo in modo da campionare eventi significativi alla ricostruzione di uno spettro di frequenze indicativo del sito di studio.

Nello specifico per ogni posizione di misura è stata realizzata una registrazione per una lunghezza non inferiore di 35 minuti in modo continuo.

La tecnica HVSR (Horizontal to Vertical Spectral Ratios) è basata sulla misura dei rapporti medi fra le ampiezze spettrali delle componenti orizzontali e verticale del rumore sismico ambientale. Le frequenze di risonanza corrispondono ai massimi della funzione che rappresenta rapporti spettrali medi in funzione della frequenza (funzione H/V). L'ampiezza di questi massimi è proporzionale (anche se non linearmente) all'entità del contrasto di impedenza sismica esistente alla base della copertura. L'idea di base è quella secondo cui il rapporto H/V consente in media di eliminare il ruolo delle variazioni di intensità delle sorgenti nel corso della registrazione mettendo in evidenza il ruolo della struttura. Sperimentalmente si vede che, in presenza di un campo d'onde diffuso, la forma della funzione (e in particolare la posizione dei suoi valori massimi) risulta con buona approssimazione stabile nel tempo e fortemente correlata con le caratteristiche del sottosuolo al di sotto del sito di misura. In particolare, in presenza di forti variazioni nel profilo di velocità delle onde S nel sottosuolo (legate per esempio alla transizione fra sedimenti soffici e basamento rigido), la funzione H/V mostra dei massimi marcati in corrispondenza della frequenza di risonanza fr relativa a quella configurazione strutturale (con fr circa uguale al rapporto fra la velocità media delle onde S fino alla profondità del salto di velocità e il quadruplo di questa profondità). Si osserva anche una certa correlazione (fortemente non lineare) fra l'entità della variazione di velocità responsabile dei fenomeni di risonanza e l'ampiezza del massimo della funzione H/V (maggiore è il contrasto di impedenza sismica, maggiore è l'entità del massimo).

La struttura del campo d'onde presente nel terreno (rumore sismico ambientale, microtremore, rumore sismico o seismic noise) è condizionata dalle caratteristiche delle sorgenti che lo determinano (siano esse naturali o antropiche) e dalle proprietà meccaniche dei terreni. Infatti, ciascuna sorgente genera un treno d'onde che raggiunge il punto di misura con

caratteristiche che dipendono dall'entità delle sollecitazioni nelle componenti orizzontali e verticali del moto e dalle modalità di propagazione fra la sorgente e il sito in funzione dei fenomeni di riflessione, rifrazione e diffrazione che hanno luogo in corrispondenza di variazioni delle proprietà meccaniche dei terreni nel sottosuolo. In genere, nel campo di rumore ambientale, saranno presenti sia onde di volume (P e S in quantità variabili) che onde superficiali (Love e Rayleigh).

Se si considera un intervallo di tempo opportunamente lungo (dell'ordine delle decine di minuti), le proprietà medie di un campo d'onde sismiche generato da una molteplicità di sorgenti differenti, distribuite casualmente attorno a un punto di misura, tendono ad avere un andamento che non dipende dalle singole sorgenti che hanno generato il campo, ma solo dalle proprietà del mezzo in cui le onde si propagano e dal livello energetico medio dell'attività antropica o naturale. In particolare, si può immaginare che, in media, le componenti orizzontali e verticali del moto del suolo tendano a essere sollecitate in modo equivalente, con un'ampiezza media pari al livello medio del rumore in quell'intervallo temporale. In questa ipotesi, i rapporti fra le ampiezze verticali e orizzontali del moto (H/V) saranno statisticamente indipendenti dalle caratteristiche delle sorgenti (dato che le ampiezze delle sollecitazioni sul piano orizzontale e verticale sono mediamente le stesse) e saranno condizionate dai soli effetti di propagazione ovvero dalle caratteristiche del mezzo interessato dal moto sismico. Queste ultime influenzeranno l'ampiezza relativa delle diverse fasi sismiche (onde P, S, Rayleigh e Love) e le direzioni di emergenza delle onde al punto di misura.

Si può dimostrare che la frequenza di risonanza v_0 di una copertura sedimentaria di spessore H sovrapposta a un basamento rigido e in condizioni di stratificazione piana è data dal rapporto fra la velocità media delle onde S nel sedimento (Vs) e 4 volte lo spessore H (v_0 = Vs/4H). Utilizzando questa relazione è possibile risalire dalla frequenza di risonanza misurata allo spessore della copertura una volta nota la velocità delle onde di taglio o, viceversa a questa ultima se lo spessore H è noto. Studi teorici mostrano che se il rumore è effettivamente dominato da onde di volume emergenti da direzioni sub-verticali, l'andamento e l'ampiezza della funzione H/V riflettono quelle della funzione di risposta del deposito sedimentario analizzato. In caso contrario si vede che l'ampiezza dei massimi della funzione H/V è correlata (ma non linearmente) all'entità del contrasto di impedenza sismica presente alla base della copertura. L'assenza di massimi della funzione H/V suggerisce l'assenza di fenomeni di amplificazione sismica dovuti a fenomeni di risonanza.

La misura della funzione H/V è stata effettuata tramite l'acquisizione del rumore sismico ambientale per ogni punto per un tempo di trenta minuti. Questa durata ha lo scopo di garantire la misura del campo di rumore generato da una molteplicità di sorgenti dalle diverse direzioni dello spazio. La misura è stata effettuata utilizzando un sistema di acquisizione tri-direzionale caratterizzato da sufficiente sensibilità. I risultati di ogni analisi presentati in questo lavoro sono stati ottenuti con il software NAKAS, che permette di determinare i rapporti medi fra le componenti spettrali del rumore misurate sul piano orizzontale e verticale. A questo scopo, la serie di rumore ambientale è stata suddivisa in una serie di finestre temporali di uguale durata (finestre di 10 secondi) per ciascuna delle quali è stato determinato lo spettro del moto. Su ciascuna di queste finestre viene calcolato lo spettro di ampiezza del segnale nelle tre componenti. In questa fase è stato applicato un sistema di lisciamento (smoothing) adottato per la determinazione dello spettro.

Dopo un opportuno lisciamento, le ordinate spettrali del moto sul piano orizzontale, ottenute mediando opportunamente i valori ottenuti nelle due direzioni principali, sono state divise per quelle ottenute nella direzione verticale. L'andamento dei rapporti spettrali è stato quindi ottenuto mediando i valori ottenuti per le diverse finestre temporali considerate. Per definire la qualità delle misure sono state anche valutate le variazioni temporali e azimutali dei rapporti spettrali nel corso della sessione di misura e fatta una stima del relativo intervallo di confidenza.

Di seguito sarà brevemente descritta la procedura di analisi seguita:

- Ciascuna delle tracce è suddivisa in segmenti o finestre di 10 secondi.
- In ogni finestra e per ciascuna delle tracce viene eseguita:
    - un'analisi preliminare: eliminazione di trend lineari (detrend) e tapering delle estremità.
    - la trasformata di Fourier (FFT)
    - il lisciamento degli spettri con finestra triangolare ampia una frazione della frequenza centrale.
- Le ampiezze spettrali delle componenti orizzontali vengono mediate in modo geometrico, e vengono calcolati i rapporti HVSR (f), in ciascuna finestra temporale.
- Si calcolano i rapporti HVSR medi ed il relativo intervallo di confidenza al 95%. Alla frequenza di risonanza viene associata una stima dell'incertezza sperimentale.

Lo spettro relativo alla componente orizzontale viene ottenuto effettuando la media (solitamente geometrica) delle due componenti spettrali del rumore sul piano orizzontale. La combinazione delle stime ottenute nelle diverse finestre temporali viene poi utilizzata per costruire la funzione H/V finale e stimare il relativo intervallo di confidenza. In particolare, la funzione H/V è ottenuta facendo la media dei valori delle funzioni H/V calcolate in ogni finestra temporale. Per verificare se le misure sono state effettuate in condizioni ottimali per i fini geognostici (campo d'onde diffuso), oltre alla stima della curva H/V, risulta quindi utile valutare l'eventuale presenza di fenomeni direzionali (eterogeneità del campo di rumore) e la stabilità nel tempo della funzione H/V durante la misura (stazionarietà). In presenza di un campo di rumore diffuso il valore della funzione H/V non deve cambiare nel tempo o al variare della direzione. Al contrario, la presenza di sorgenti dominanti o il cattivo posizionamento dello strumento (basculamento) si manifesta come una variazione direzionale e/o temporale dei rapporti H/V.

Sperimentalmente, l'analisi di qualità della misura può essere effettuata confrontando le ampiezze spettrali medie del rumore misurato lungo le due componenti orizzontali, oppure calcolare diversi valori della funzione H/V di volta in volta proiettando lungo direzioni differenti le ampiezze spettrali ottenute sul piano orizzontale (Figura 4). La stazionarietà nel tempo, invece, può essere valutata rappresentando in funzione del tempo le funzioni H/V ottenute nelle diverse finestre temporali considerate.

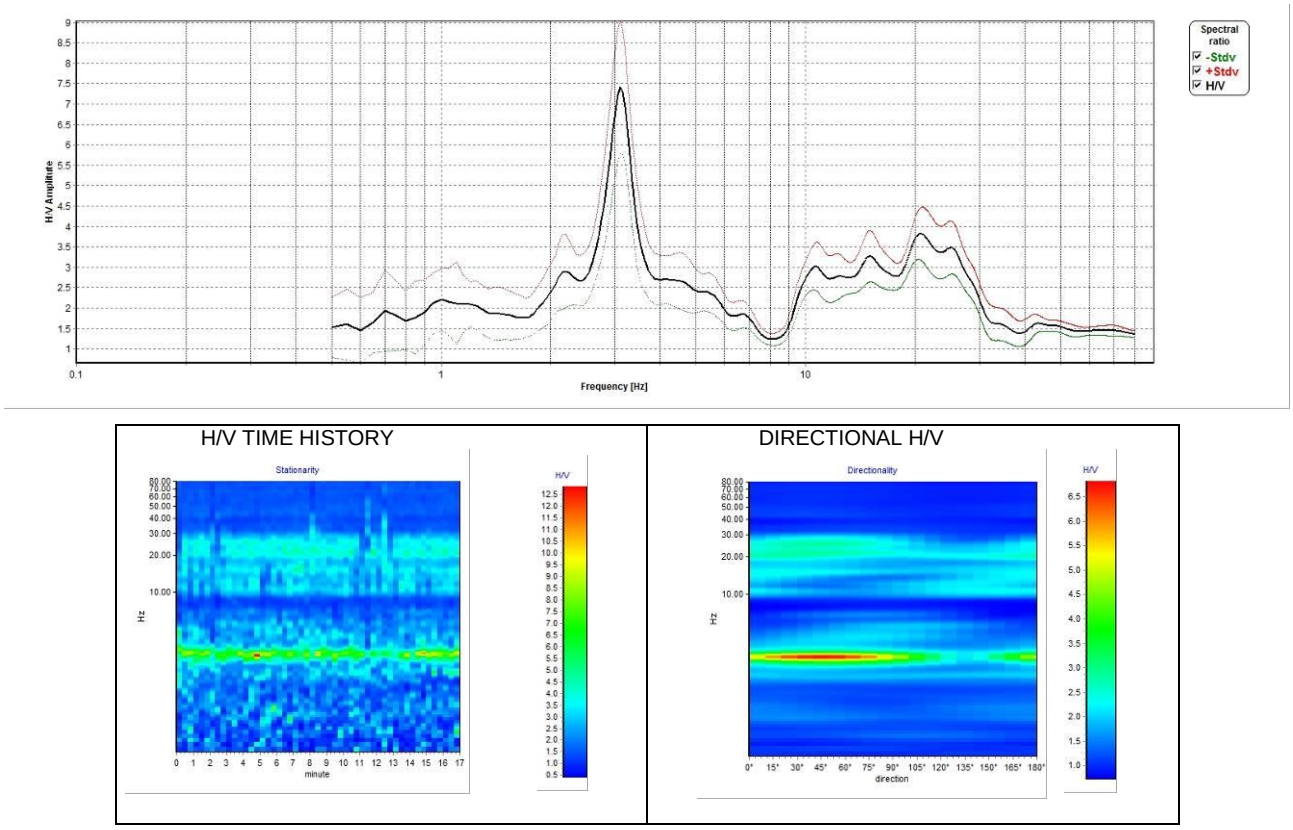


Figura 4: Risultati delle analisi di rumore sismico relative a una corretta misura H/V. In alto sono riportati i valori del rapporto spettrale H/V in funzione della frequenza con il relativo intervallo di confidenza al 95%. Sono anche indicati i valori delle frequenze corrispondenti ai massimi della funzione H/V. In basso a sinistra è riportato l'andamento nel tempo (ascissa) dei valori H/V (colori) in funzione della frequenza (ordinata): il grafico ha lo scopo di valutare la stabilità nel tempo della curva H/V. In basso a destra sono invece riportati i valori della funzione H/V (colore) in funzione della frequenza (in ordinata) al variare della direzione del segnale (ascissa): il grafico serve a valutare la direzionalità del segnale registrato.

Ai fini dell'affidabilità e della chiarezza del massimo della funzione H/V, infine è stata effettuata un'analisi secondo i criteri determinati nell'ambito del progetto europeo SESAME per l'eliminazione di massimi spuri della funzione H/V, la cui presenza è frutto delle caratteristiche del campo d'onde sismiche e non della struttura locale del sottosuolo. Infine, un buon indicatore della qualità del picco H/V può essere ottenuto dall'esame degli spettri singoli. Infatti, massimi fisicamente significativi sono generalmente associati a valori di ampiezza spettrale minima sulla componente verticale.

5.4 Onde superficiali MASW e ESAC

La conoscenza dell'andamento nel primo sottosuolo della velocità di propagazione delle onde di taglio è, come noto, importante negli studi di microzonazione sismica dedicati alla stima di possibili effetti di sito, capaci di amplificare il moto del terreno durante un terremoto.

Negli ultimi anni hanno avuto ampio sviluppo tecniche geofisiche basate sull'analisi della propagazione delle onde superficiali e, in particolare, delle onde di Rayleigh.

Le proprietà dispersive di tali onde in mezzi stratificati, nonché la stretta relazione esistente tra la loro velocità di propagazione e quella delle onde di taglio, consentono di risalire al profilo di velocità delle onde S. Tuttavia, diversi studi hanno messo in evidenza come, la velocità delle onde P e la densità sono parametri di secondo ordine rispetto alle onde S nel determinare la velocità di fase delle onde di Rayleigh. Quindi, dato che le onde superficiali campionano una porzione di sottosuolo che cresce in funzione del periodo dell'onda e che la loro velocità di fase è fortemente condizionata in massima parte dalle velocità delle onde S dello strato campionato, la forma di questa curva è essenzialmente condizionata dalla struttura del sottosuolo ed in particolare dalle variazioni con la profondità delle velocità delle onde S. Pertanto, utilizzando appositi formalismi è possibile stabilire una relazione (analiticamente complessa ma diretta) fra la forma della curva di dispersione e la velocità delle onde S nel sottosuolo. Tale relazione consente il calcolo di curve di dispersione teoriche a partire da modelli del sottosuolo a strati piano-paralleli. L'operazione d'inversione, quindi, consiste nella minimizzazione, attraverso una procedura interattiva, degli scarti tra i valori di velocità di fase sperimentali delle curve di dispersione e quelli teorici relativi ad una serie di modelli di prova "velocità delle onde S - profondità". Tali studi, effettuati con metodologie distinte tra le quali Refraction Microtremor (Re.Mi.) e Multi-channel Analysis of Surface Waves (MASW), permettono di definire il parametro Vs30 utile per la classificazione dei terreni nelle categorie di suolo da utilizzare in seguito per la progettazione delle costruzioni secondo la normativa antisismica.

Il parametro Vs30 determinato attraverso questo particolare tipo d'indagine di risposta sismica locale corrisponde alla velocità equivalente di propagazione entro i primi 30 metri di profondità delle onde superficiali ed è calcolata con la seguente espressione:

$$Vs_{30} = \frac{30}{\sum_{i=1,N} \frac{h_i}{V_i}}$$

dove hi e Vi indicano rispettivamente lo spessore (in m) e la velocità delle onde S (per deformazioni di taglio $\gamma < 10-6$) dello strato i-esimo, per un totale di N strati presenti nei primi 30 metri di profondità.

5.5 Onde superficiali MASW

Il metodo di indagine attivo MASW (Multichannel Analysis of Surface Waves) è basato sullo studio spettrale delle onde superficiali presenti in un sismogramma realizzato per mezzo di un'energizzazione sismica artificiale (Nazarian e Stokoe, 1984; Park et al.,1999).

Lo scopo della prova MASW è quello di ricostruire il profilo di rigidezza del sito tramite la misura della velocità di propagazione delle onde di superficie di Rayleigh, con un successivo processo d'inversione, attraverso il quale è fornita una stima indiretta della distribuzione delle onde Vs (velocità di propagazione delle onde di taglio).

La prova consiste nel produrre in un punto sulla superficie del terreno, in corrispondenza del sito da investigare, una sollecitazione dinamica verticale e nel registrare tramite uno stendimento lineare di sensori, le vibrazioni prodotte, sempre in corrispondenza della superficie, a distanze note e prefissate.

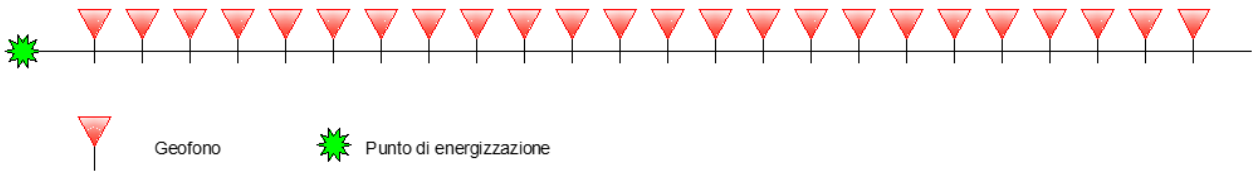


Figura 5: Rappresentazione schematica di array per acquisizione di MASW

In riferimento all'indagine geofisica la prova MASW è stata acquisita con le seguenti caratteristiche:

- Numero geofoni: 24;
- Spaziatura dei geofoni: 2,5 metri;
- Frequenza geofoni: 4.5 Hz;
- Tempo di registrazione degli eventi: 2 s;
- Tempo di campionamento: 0.25 x 10^{-3} s;
- offset minimo 2,5 – 5 –7,5 metri

La metodologia "MASW" consente di eseguire un'analisi dei dati sismici in modo tale da poter ricavare il profilo verticale della velocità delle onde S; inoltre, essa permette di definire il parametro Vs30, utile per la classificazione dei terreni nelle categorie di suolo, funzionale alla descrizione dell'azione sismica in sito. Il profilo verticale delle velocità sismiche delle onde S (Vs) è ottenuto tramite l'inversione (considerando tanto il modo fondamentale che quelli superiori) delle curve di dispersione delle onde di Rayleigh. Una volta ottenuto il sismogramma, si procede a determinare lo spettro di velocità sul quale si identifica la curva di dispersione.

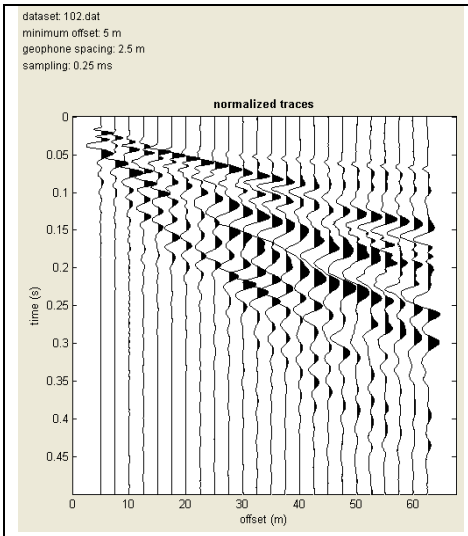


Figura 6: Sismogramma

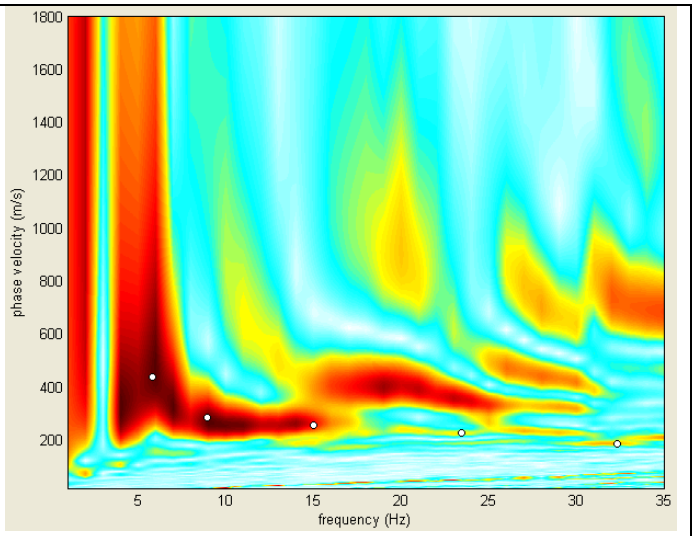


Figura 7: Spettro di velocità con curva di dispersione e picking

Il profilo verticale di Vs si ottiene con l'inversione della curva di dispersione precedentemente "piccata" (cerchietti neri fig. 7). Tale inversione è eseguita tramite l'utilizzo di algoritmi genetici che consentono di ottenere soluzioni affidabili ed una stima dell'attendibilità del modello ricavato in termini di deviazione standard.

L'operazione di inversione è ottimizzata definendo uno spazio di ricerca i cui confini sono definiti da valori di Vs e spessori all'interno dei quali si cerca la soluzione. Tali assunzioni sono fatte sulla base delle conoscenze geologiche del sito e delle informazioni derivate dalla sismica a rifrazione.

Una volta fissati i limiti minimi e massimi dello spazio di ricerca, sono quindi impostati i parametri genetici che definiscono sia il numero di individui (ossia il numero di modelli che costituiscono la popolazione che si evolverà verso soluzioni sempre migliori) sia il numero di generazioni al passare delle quali sono esplorati modelli sempre migliori.

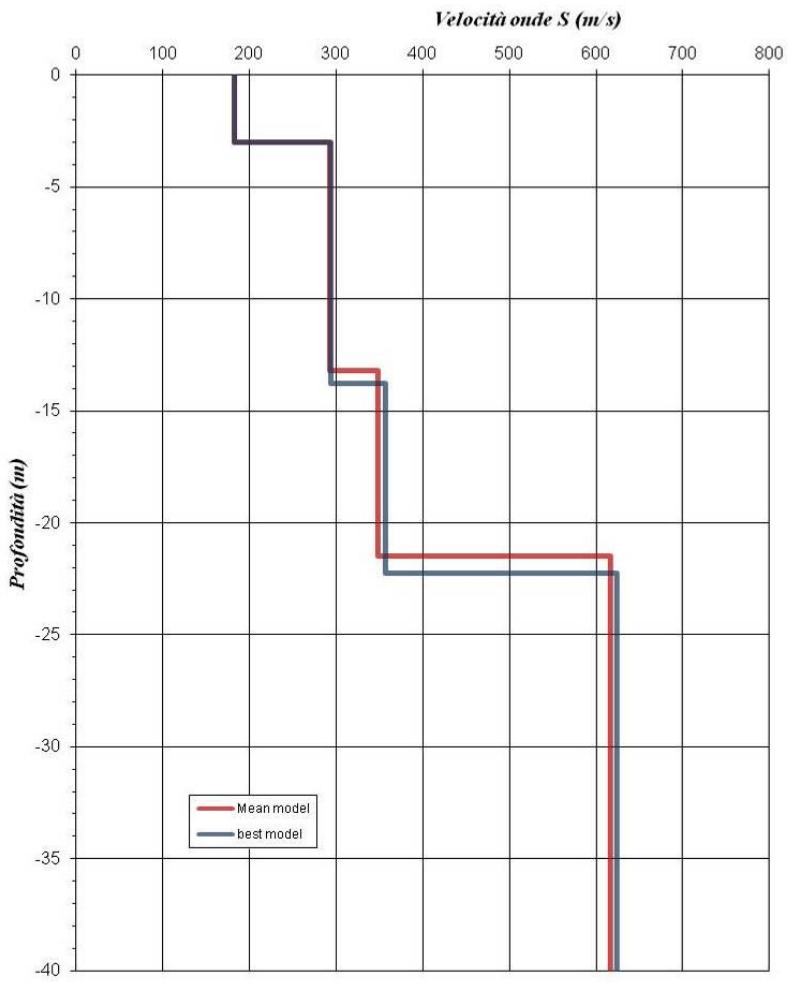


Figura 8: Modello interpretativo

5.6 Onde superficiali ESAC

Il metodo di indagine ESAC (Extended Spatial Auto - Correlation) è basato sullo studio spettrale delle onde superficiali presenti in una registrazione sismica di microtremori naturali e/o artificiali a bassa frequenza, che si propagano all'interno del mezzo indagato.

Lo scopo della prova ESAC consiste nel determinare il profilo di rigidezza del sito tramite la misura della velocità di propagazione delle onde di superficie di Rayleigh ed un successivo processo d'inversione, attraverso il quale è fornita una stima indiretta della distribuzione delle Vs (velocità di propagazione delle onde di taglio). L'acquisizione dei dati è stata eseguita utilizzando la strumentazione classica per la prospezione sismica a rifrazione (a geofono singolo; vedi figura 9) disposta sul terreno con array lineare da 24 geofoni disposta su direttrici ortogonali tra loro.

In riferimento all'indagine geofisica la prova ESAC è stata acquisita con le seguenti caratteristiche:

- Numero geofoni: 24;
- Spaziatura dei geofoni: 2,5 e 5,0 metri;
- Frequenza geofoni: 4,5 Hz;
- Tempo di registrazione degli eventi: 30 s;
- Tempo di campionamento: 2×10^{-3} s;
- n° 8 registrazioni.

L'elaborazione del segnale consiste nell'operare una trasformata bidimensionale "slowness-frequency" (p-f), che studia l'energia di propagazione del rumore in entrambe le direzioni (orizzontale e verticale) lungo la linea sismica, nonché nel rappresentarne poi lo spettro di potenza su un grafico p-f (fig. 9).

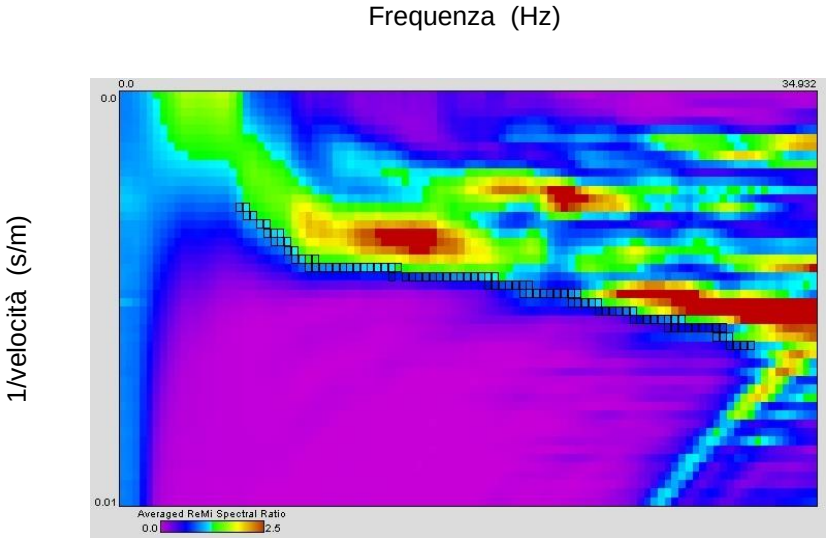


Figura 9: Grafico p-f spettro di velocità con picking della curva di dispersione

Nell'immagine sono evidenziati gli andamenti che possiedono una spiccata coerenza di fase con una potenza rilevante: ciò consente un riconoscimento visivo delle onde di Rayleigh in quanto esse presentano un carattere dispersivo diverso rispetto a quelle riconducibili ad altre modalità e tipi d'onda. Sullo spettro di frequenza si identificano i valori di slowness (inverso della velocità di fase) con i rispettivi valori di frequenza (fig. 9). I valori di picking sono riportati su di un diagramma periodo-velocità di fase (fig. 10) sui quali è sovrapposta la curva di dispersione al fine di ottimizzare il modello interpretativo.

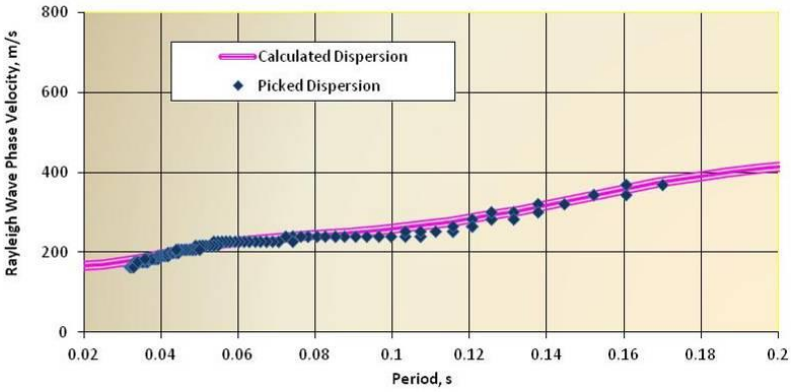


Figura 10: Diagramma periodo – velocità di fase

Variando la geometria del modello interpretativo ed i valori di velocità delle onde "S" si modifica la curva calcolata di dispersione. Raggiunto un buon fitting con i valori sperimentali si ottiene il modello interpretativo finale.

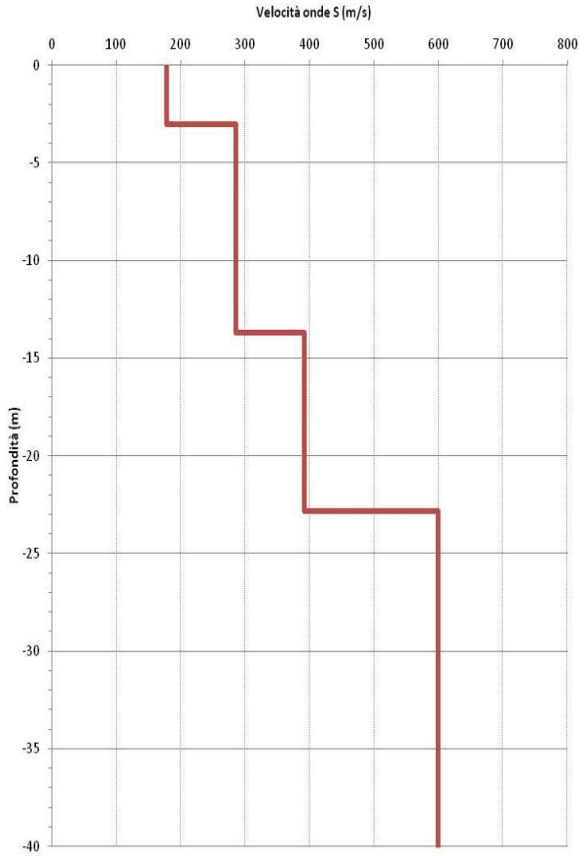


Figura 11: modello interpretativo

6. RISULTATI OTTENUTI

L'indagine sismica sviluppata ha permesso di fornire gli elementi caratteristici per la classificazione di sito e di sviluppare considerazioni significative per la definizione delle carte di microzonazione sismica.
In generale la prospezione sismica effettuata con i profili sismici tomografici delle onde P, e delle onde S ha permesso di modellizzare un assetto stratigrafico e di fornire informazioni utili alla definizione della successione stratigrafica con la definizione di geometrie e spessori nelle aree interessate del territorio del comune di Montevarchi.

Lo studio delle onde di superficie ha permesso di ricostruire una successione stratigrafica in funzione della velocità delle onde sismiche S e poter calcolare il valore di Vseq che permette di definire la categoria di suolo secondo la normativa antisismica. Per tale studio sono state utilizzate due tipologie: MASW (Multi-channel Analysis of Surface Waves) e "ESAC" (Extended Spatial Auto - Correlation), al fine di elevare il grado di attendibilità del risultato e diminuire le incertezze. Tali misure sono state sviluppate sia nelle aree pianeggianti di bacino per caratterizzare dal punto di vista dinamico le coperture alluvionali sia nelle aree con maggior rilievo.
Le misure in generale hanno fornito elementi significativi alla definizione delle caratteristiche di sito che permettono la stesura delle carte di piano e delle carte della microzonazione sismica. In particolare, si evidenzia che per la quasi totalità i siti studiati sono caratterizzati da litotipi granulari o coesivi che ricadono in classe C secondo la normativa sismica vigente o comunque fanno registrare valori prossimi al limite tra sottosuolo di tipo C e B.

Le misure HVSR hanno permesso di definire le varie curve H/V caratteristiche di sito e di definire le frequenze di risonanza dei terreni utilizzate per redigere la carta delle frequenze.
Per la maggior parte non si registrano "picchi significativi" dal punto di vista geologico, sinonimo di assenza di importanti contrasti di impedenza tra le litologie presenti in profondità. Solo in taluni casi si registrano dei picchi, di cui quelli nei siti con maggior rilievo sono posti a frequenze minore rispetto a quelli localizzati nell'area di bacino.

Misura 1 HVRS

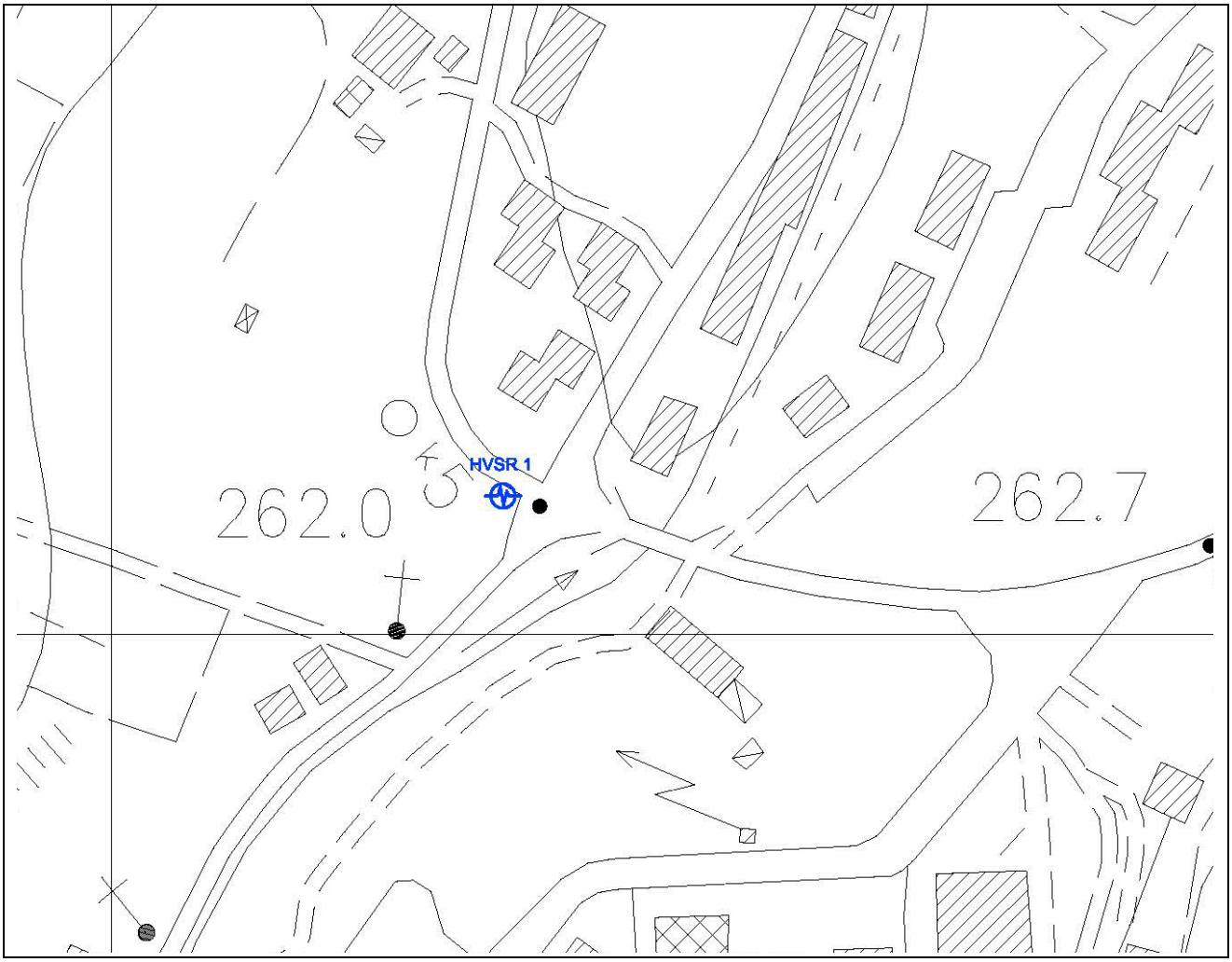


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

H/V Spectral ratio

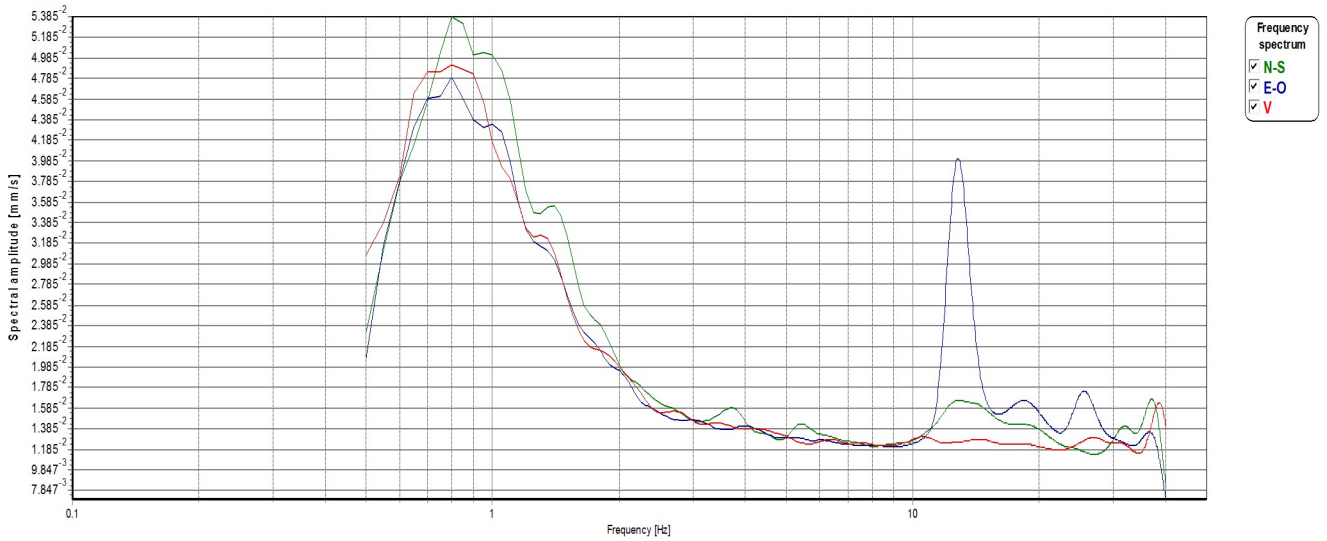
Analysis site: **Montevarchi**

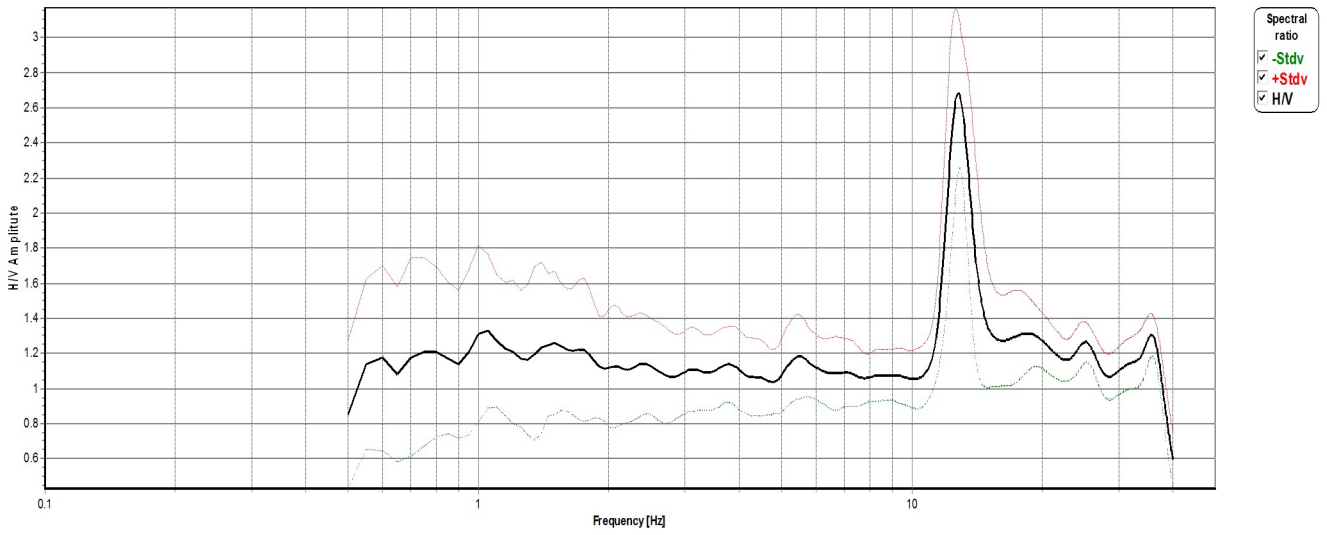
Measure point: **1 Mercatale Valdarno**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 08:16:26**
Automatic spike removal:	**No**	Stop recordings:	**18/02/2021 08:51:26**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**51**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**54**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**12.863**	Standard deviation [Hz]:	**0.419**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **1 Mercatale Valdarno**

Criteria for a reliable H/V curve		
fø > 10/Lw	**12.86 >= 0.50**	**Yes**
Nc(fø) > 200	**13120.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 386**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**3.250**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**15.050**	**Yes**
Aø > 2	**2.68 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**2.04% < 5.00%**	**Yes**
sf < e(fø)	**0.4187 < 0.6431**	**Yes**
sA(fø) < ?(fø)	**0.4232 < 1.5800**	**Yes**

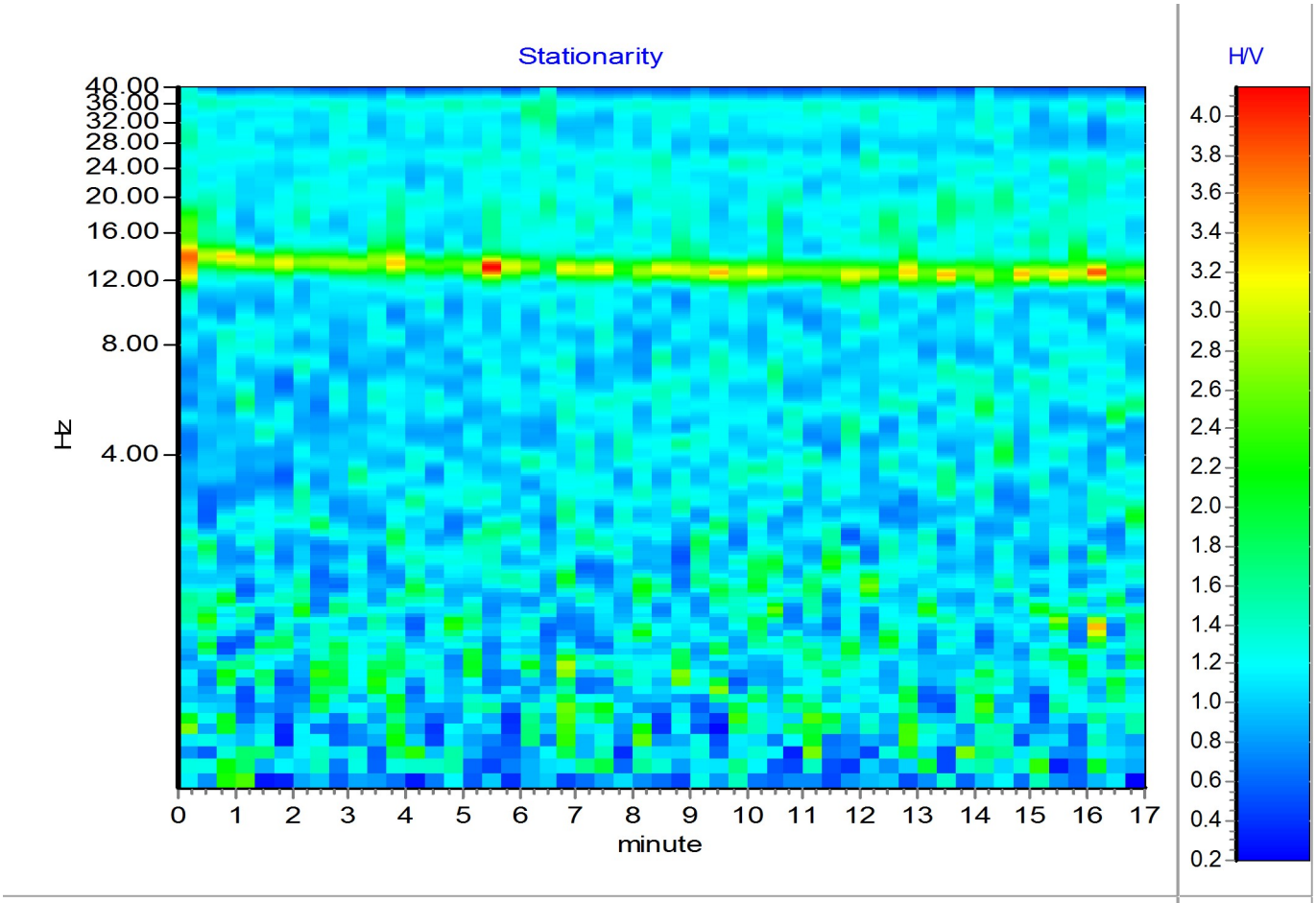
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

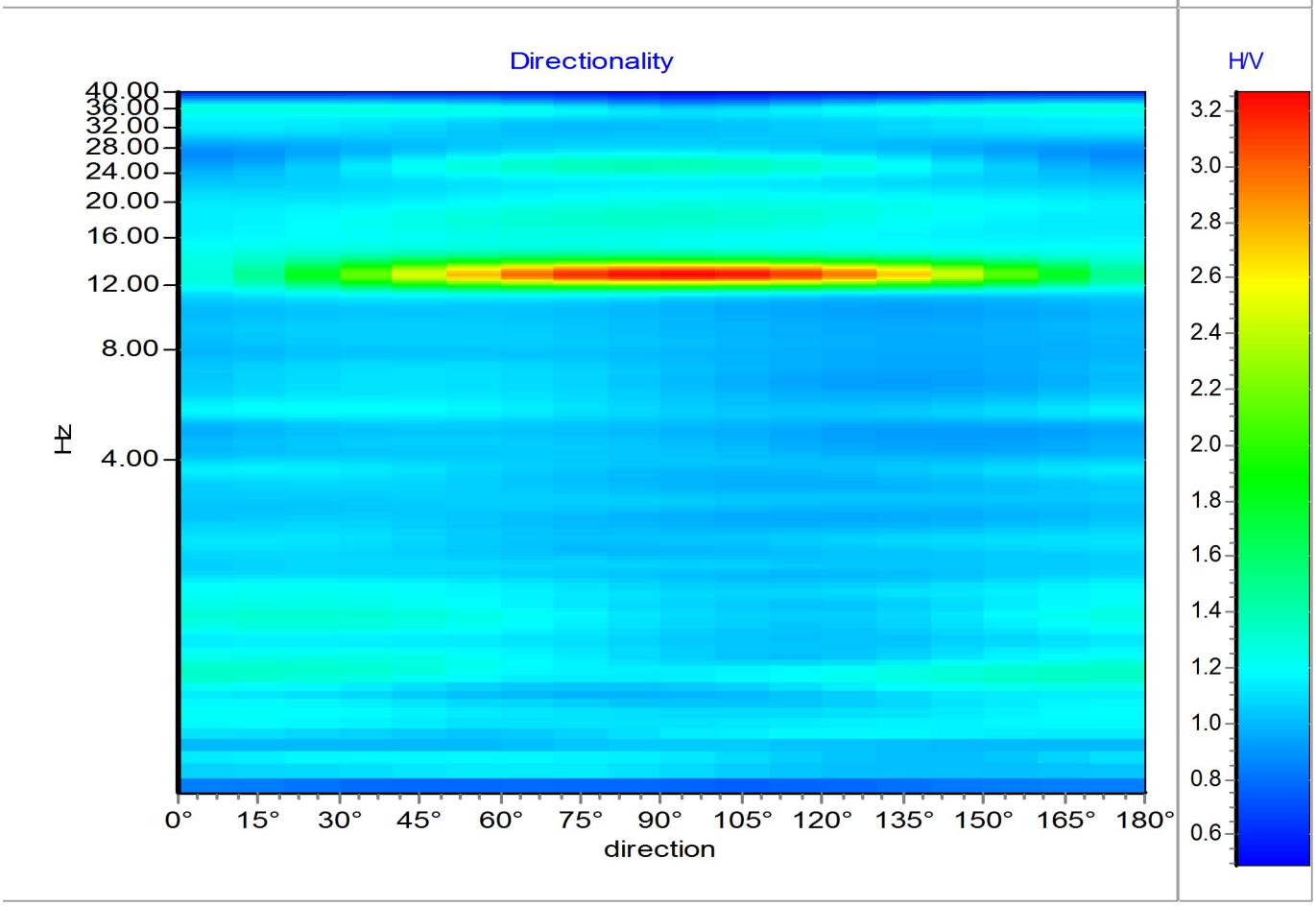
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **1 Mercatale Valdarno**





Misura 2 HVRS

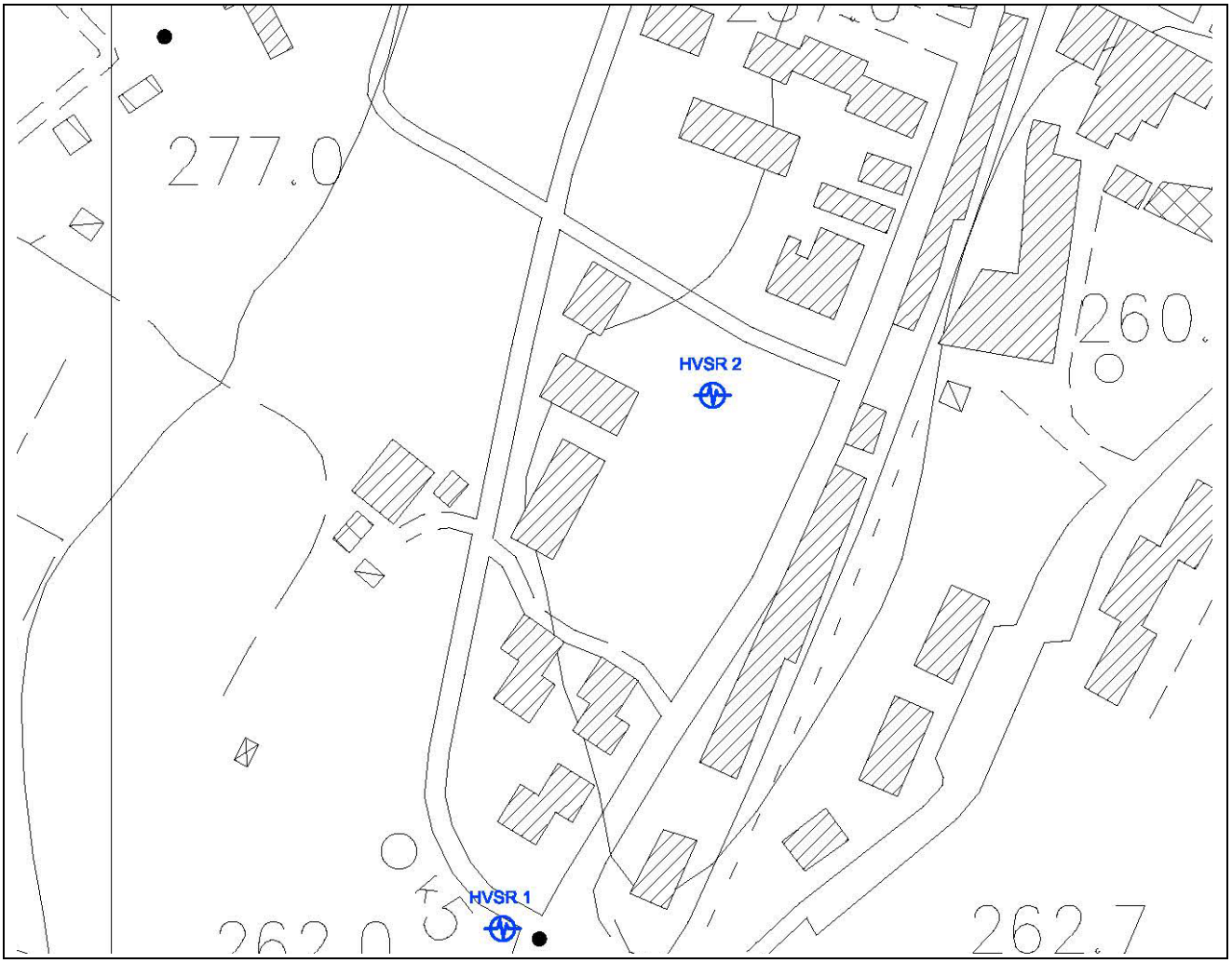


Figura 2.1 – individuazione del sito di studio – scala 1:2.000

Figura 2.2: rilievo sismico

H/V Spectral ratio

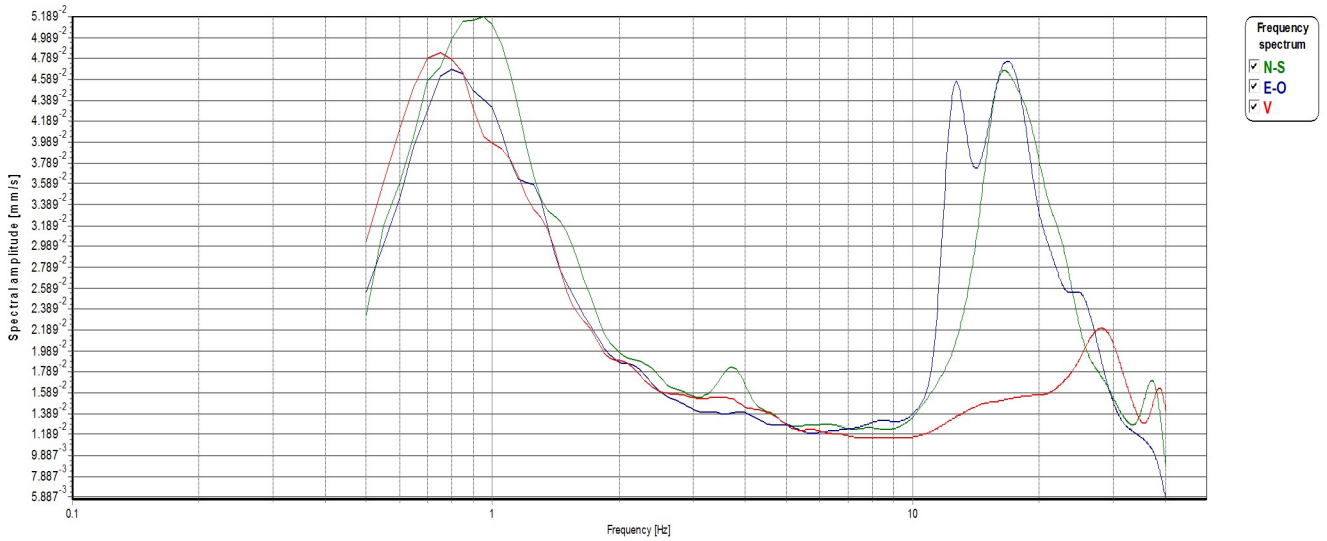
Analysis site: **Montevarchi**

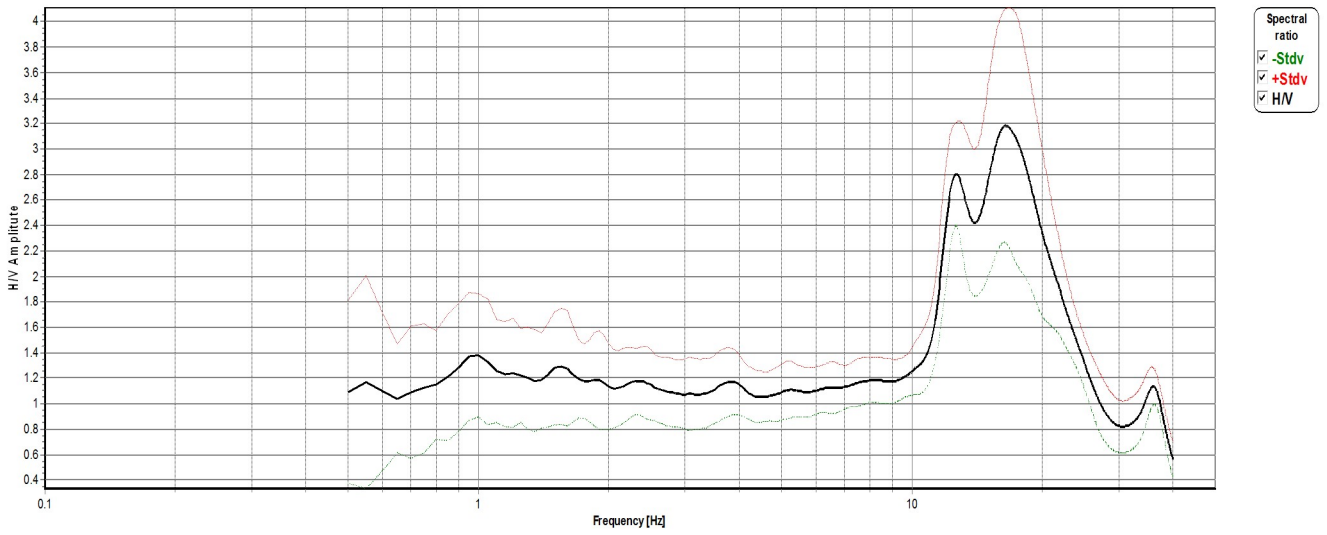
Measure point: **2 Mercatale Valdarno**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 08:59:33**
Automatic spike removal:	**No**	Stop recordings:	**18/02/2021 09:34:33**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**89**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**16**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**14.949**	Standard deviation [Hz]:	**2.151**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **2 Mercatale Valdarno**

Criteria for a reliable H/V curve		
fø > 10/Lw	**14.95 >= 0.50**	**Yes**
Nc(fø) > 200	**26609.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 448**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**3.750**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**24.750**	**Yes**
Aø > 2	**2.73 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**15.71% > 5.00%**	**No**
sf < e(fø)	**2.1505 > 0.7474**	**No**
sA(fø) < ?(fø)	**0.7419 < 1.5800**	**Yes**

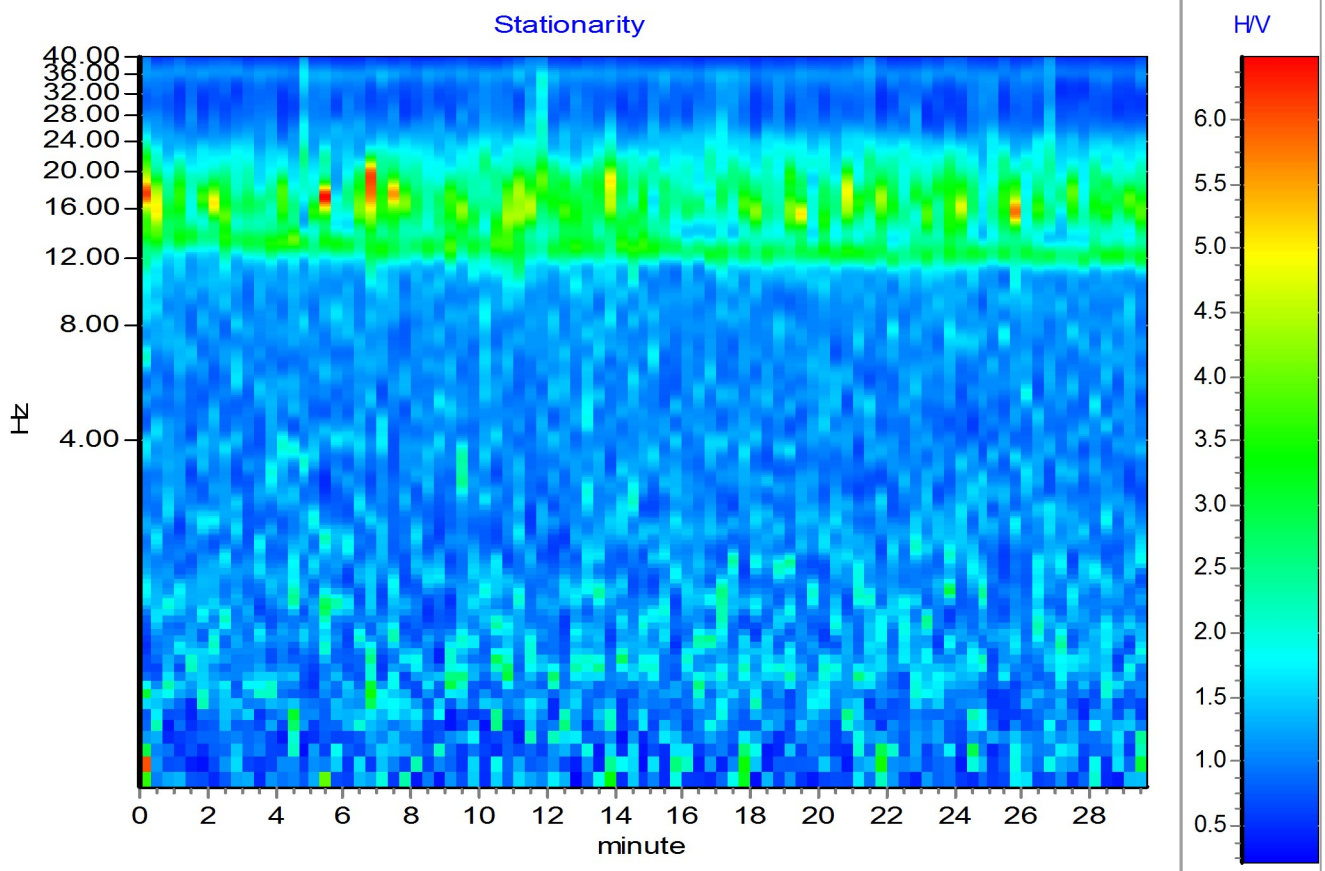
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

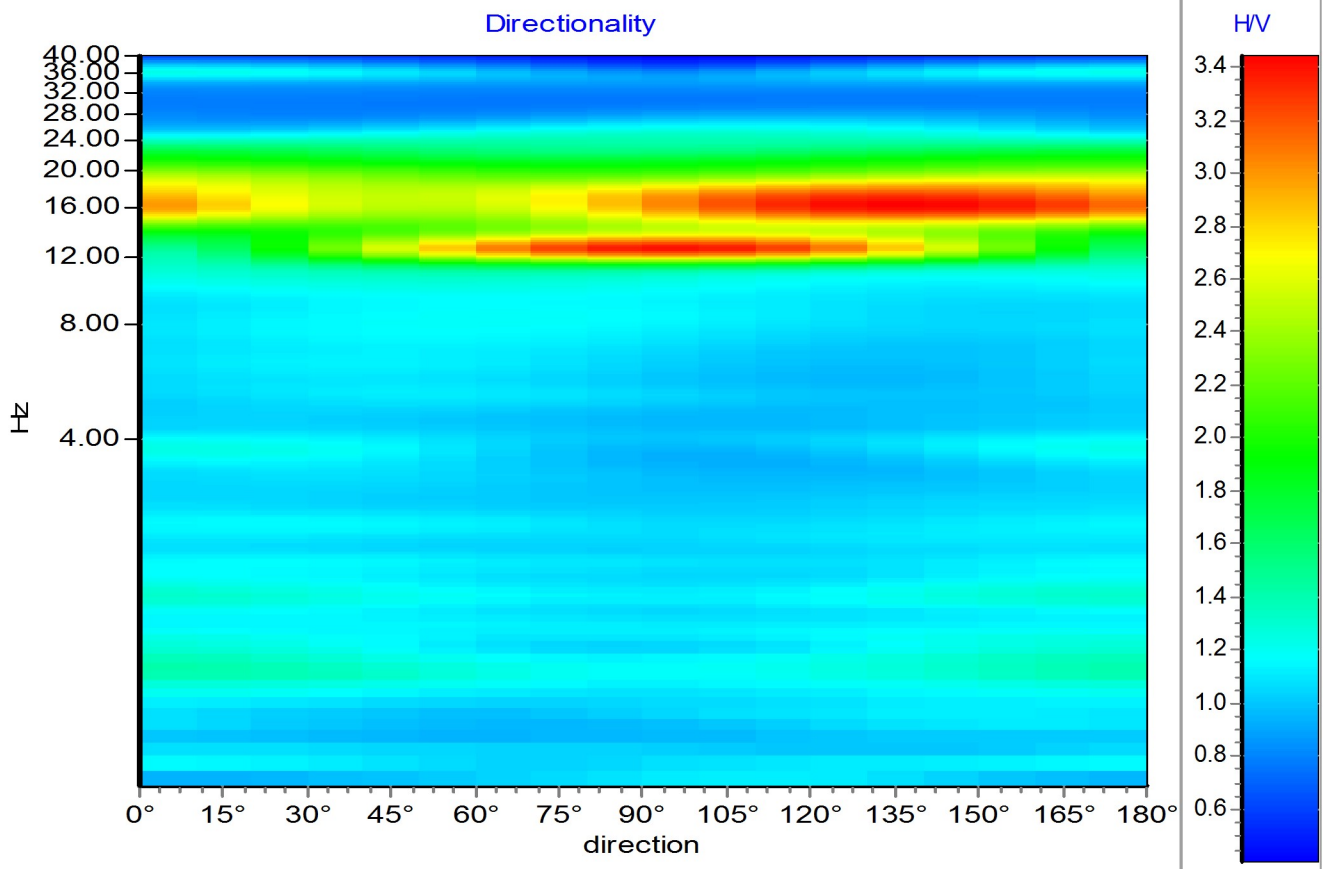
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **2 Mercatale Valdarno**





Misura 3 HVRS

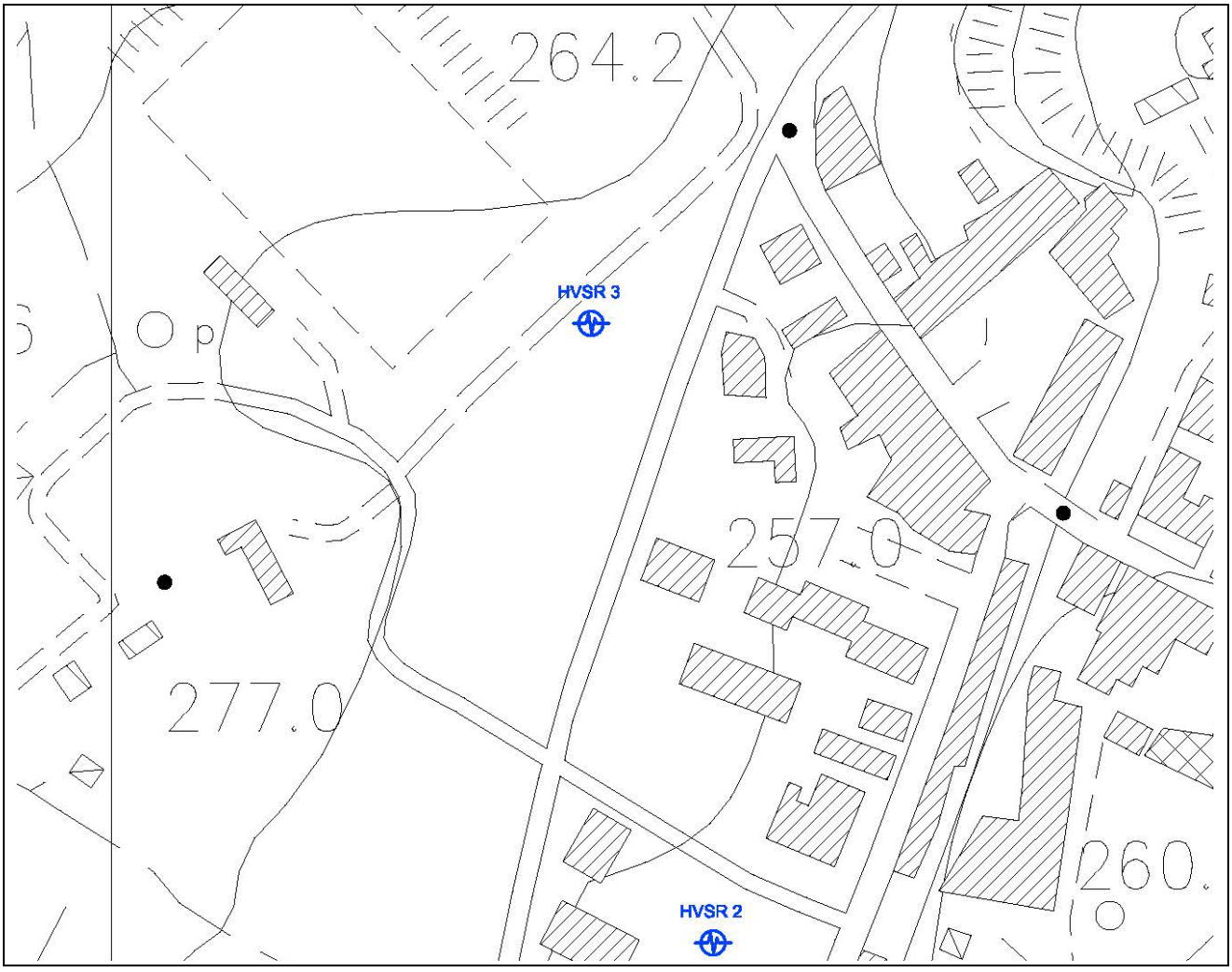


Figura 3.1 – individuazione del sito di studio - scala 1:2.000

Figura 3.2: rilievo sismico

H/V Spectral ratio

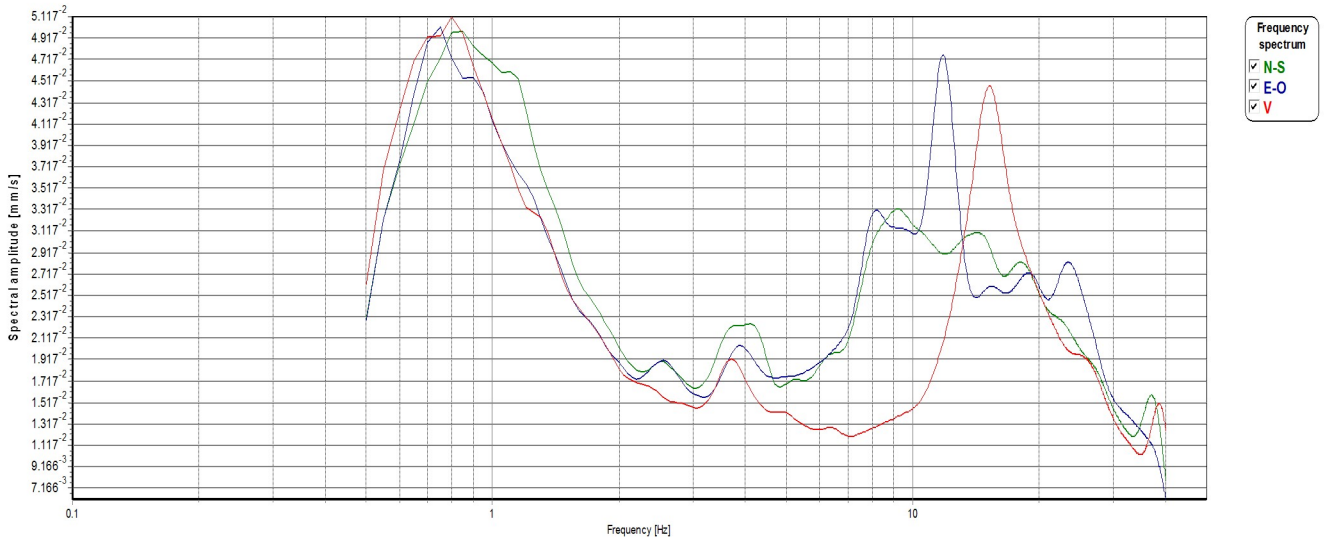
Analysis site: **Montevarchi**

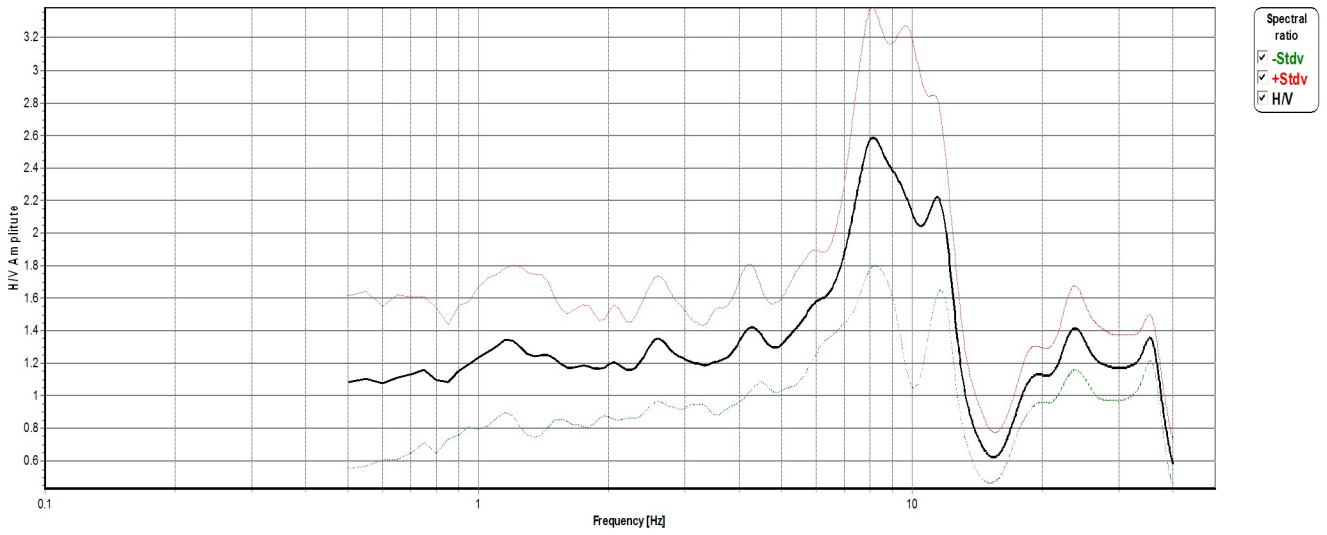
Measure point: **3 Mercatale Valdarno**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**13/02/2021 09:45:34**
Automatic spike removal:	**No**	Stop recordings:	**13/02/2021 10:20:34**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**71**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**34**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**9.387**	Standard deviation [Hz]:	**1.600**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **3 Mercatale Valdarno**

Criteria for a reliable H/V curve		
fø > 10/Lw	**9.39 >= 0.50**	**Yes**
Nc(fø) > 200	**13330.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 282**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**13.050**	**Yes**
Aø > 2	**2.30 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**13.71% > 5.00%**	**No**
sf < e(fø)	**1.6001 > 0.4694**	**No**
sA(fø) < ?(fø)	**0.9388 < 1.5800**	**Yes**

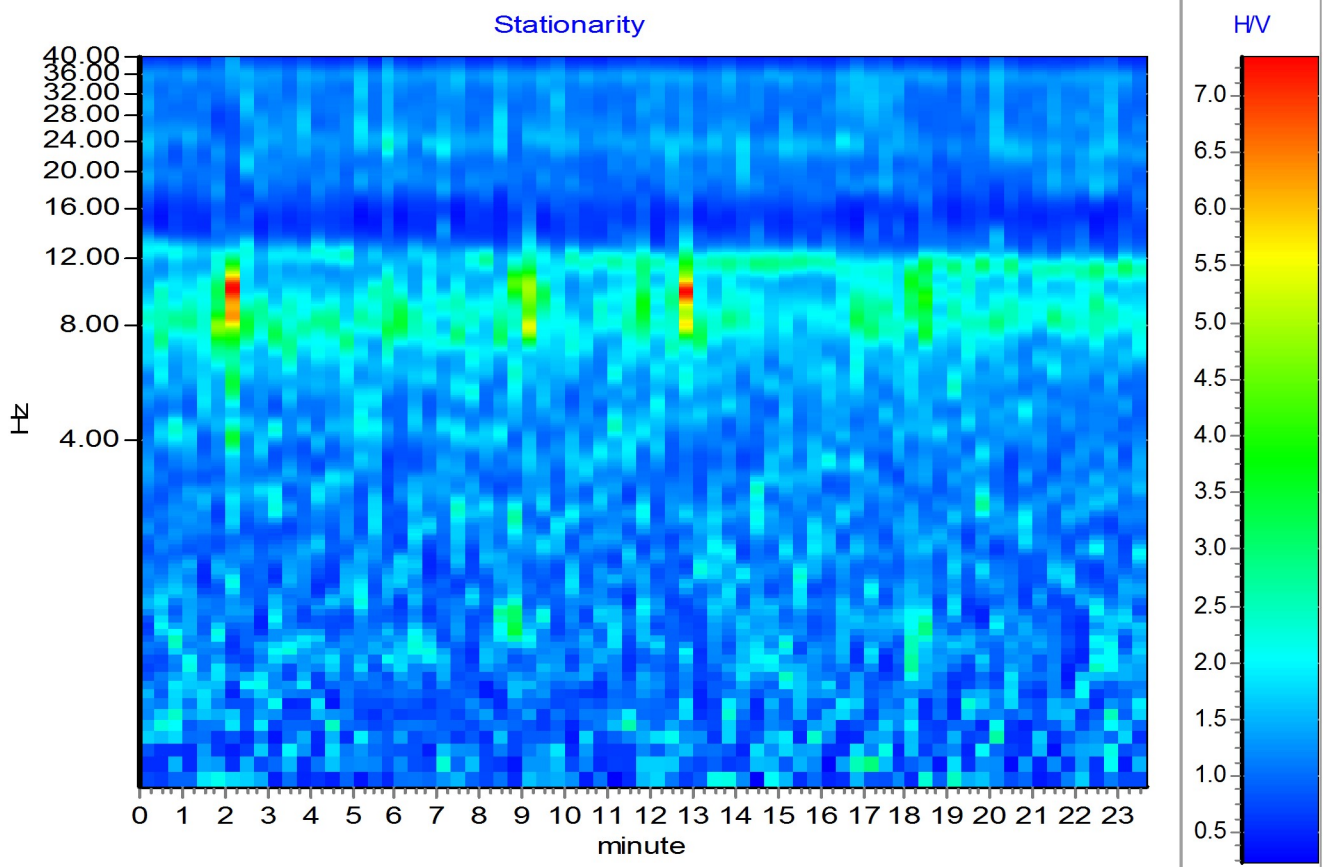
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

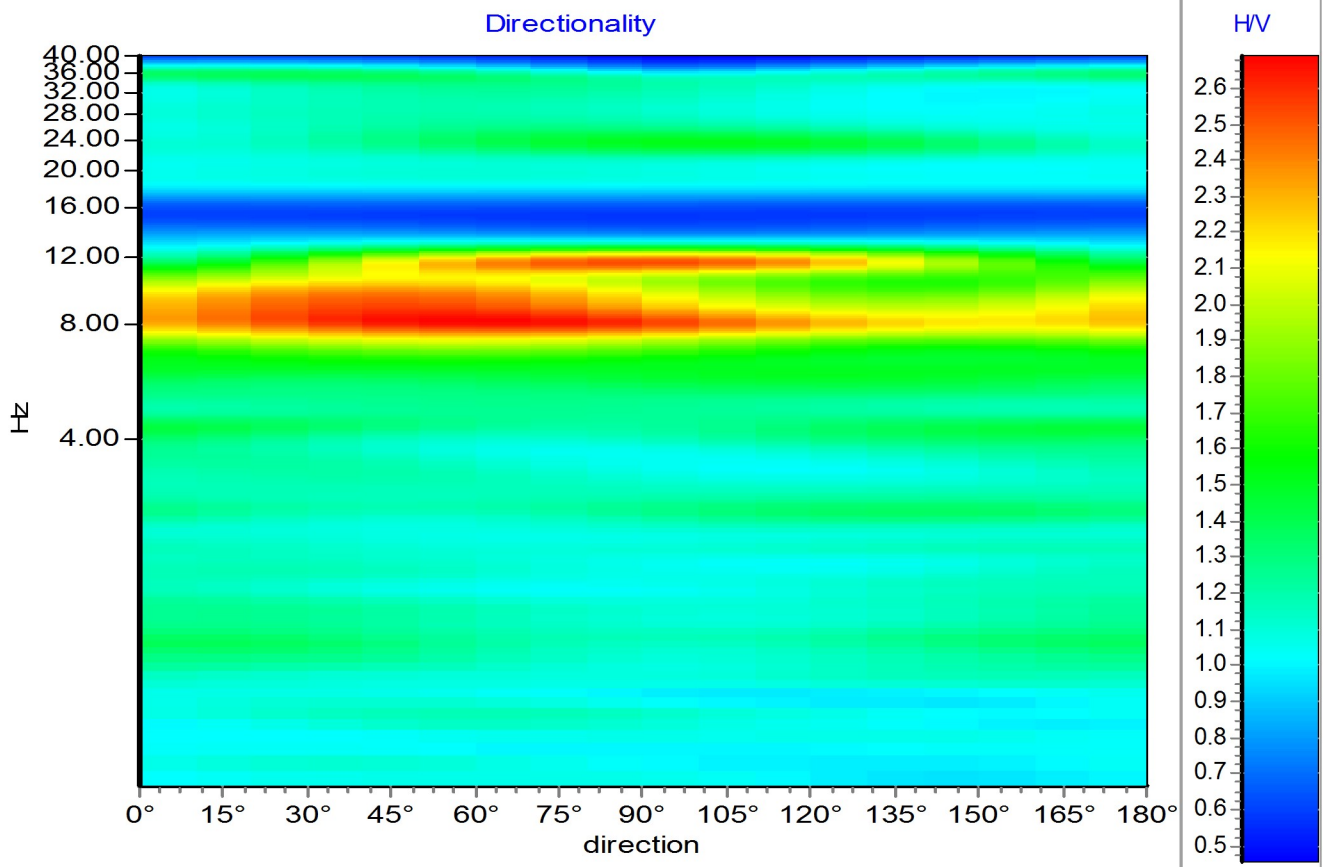
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **3 Mercatale Valdarno**





Misura 4 HVRS

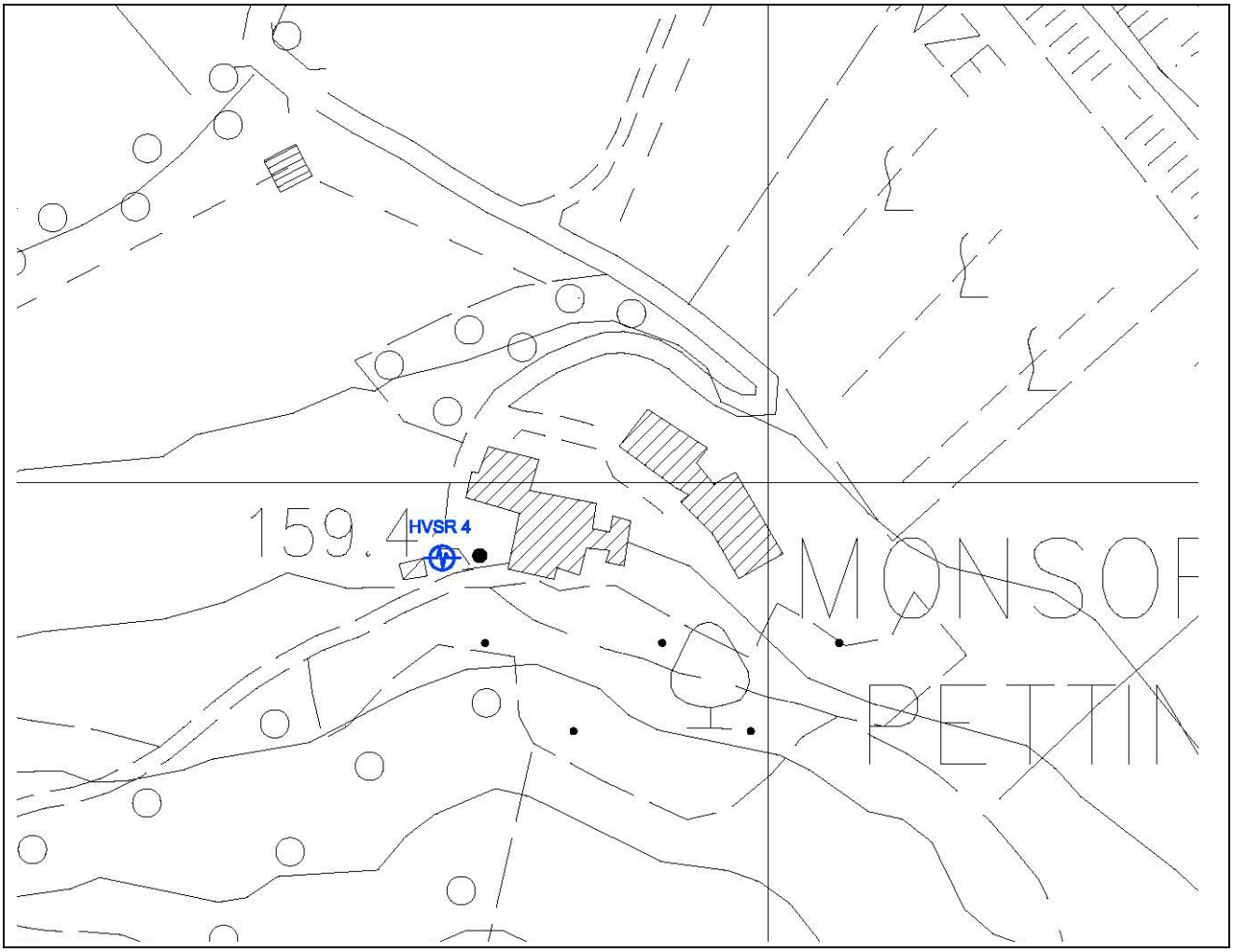


Figura 4.1 – individuazione del sito di studio - scala 1:2.000

Figura 4.2: rilievo sismico

H/V Spectral ratio

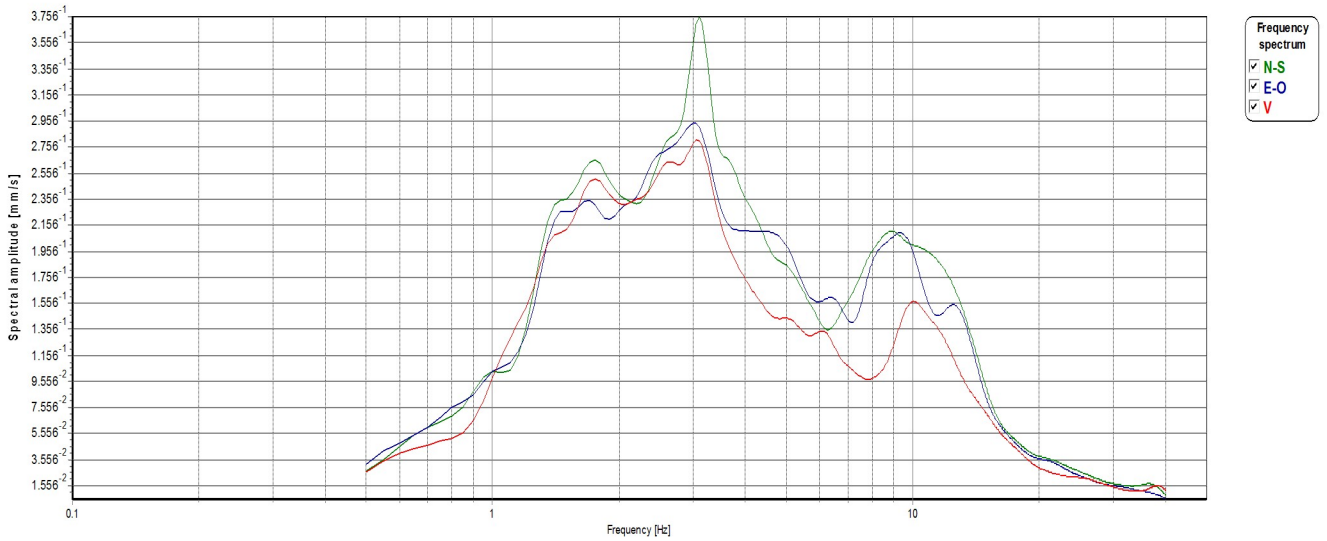
Analysis site: **Montevarchi**

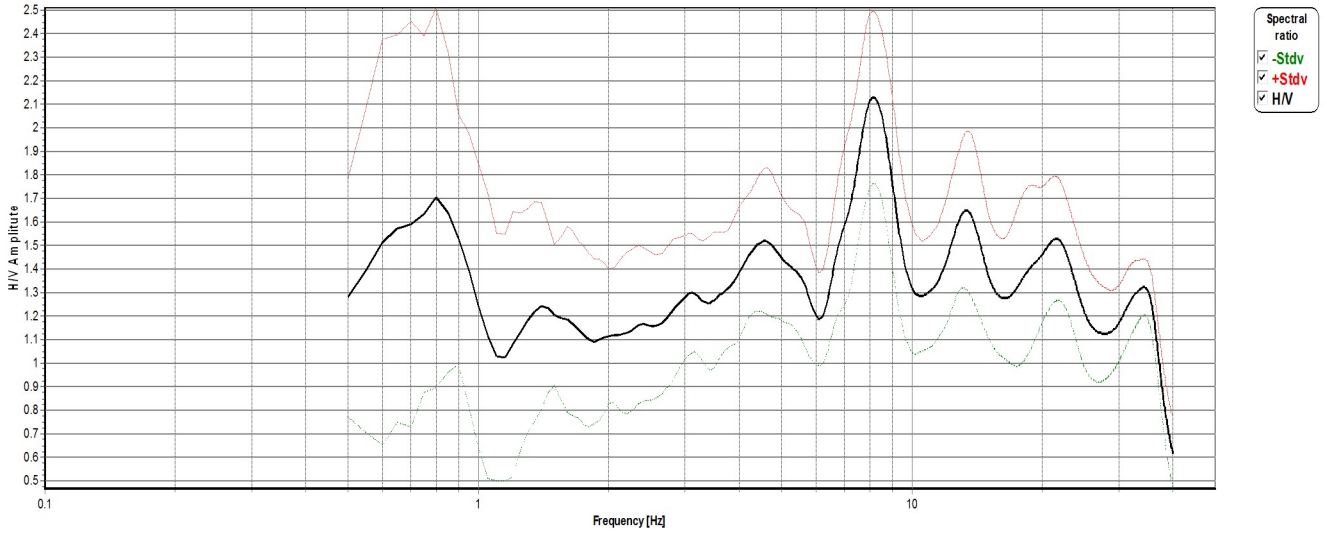
Measure point: **4 Monsorbi Pettini**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 12:04:45**
Automatic spike removal:	**No**	Stop recordings:	**18/02/2021 12:39:45**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**77**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**28**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**3.086**	Standard deviation [Hz]:	**3.456**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **4 Monsorbi Pettini**

Criteria for a reliable H/V curve		
fø > 10/Lw	**3.09 >= 0.50**	**Yes**
Nc(fø) > 200	**4753.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 93**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.30 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**165.68% > 5.00%**	**No**
sf < e(fø)	**3.4565 > 0.1543**	**No**
sA(fø) < ?(fø)	**0.2545 < 1.5800**	**Yes**

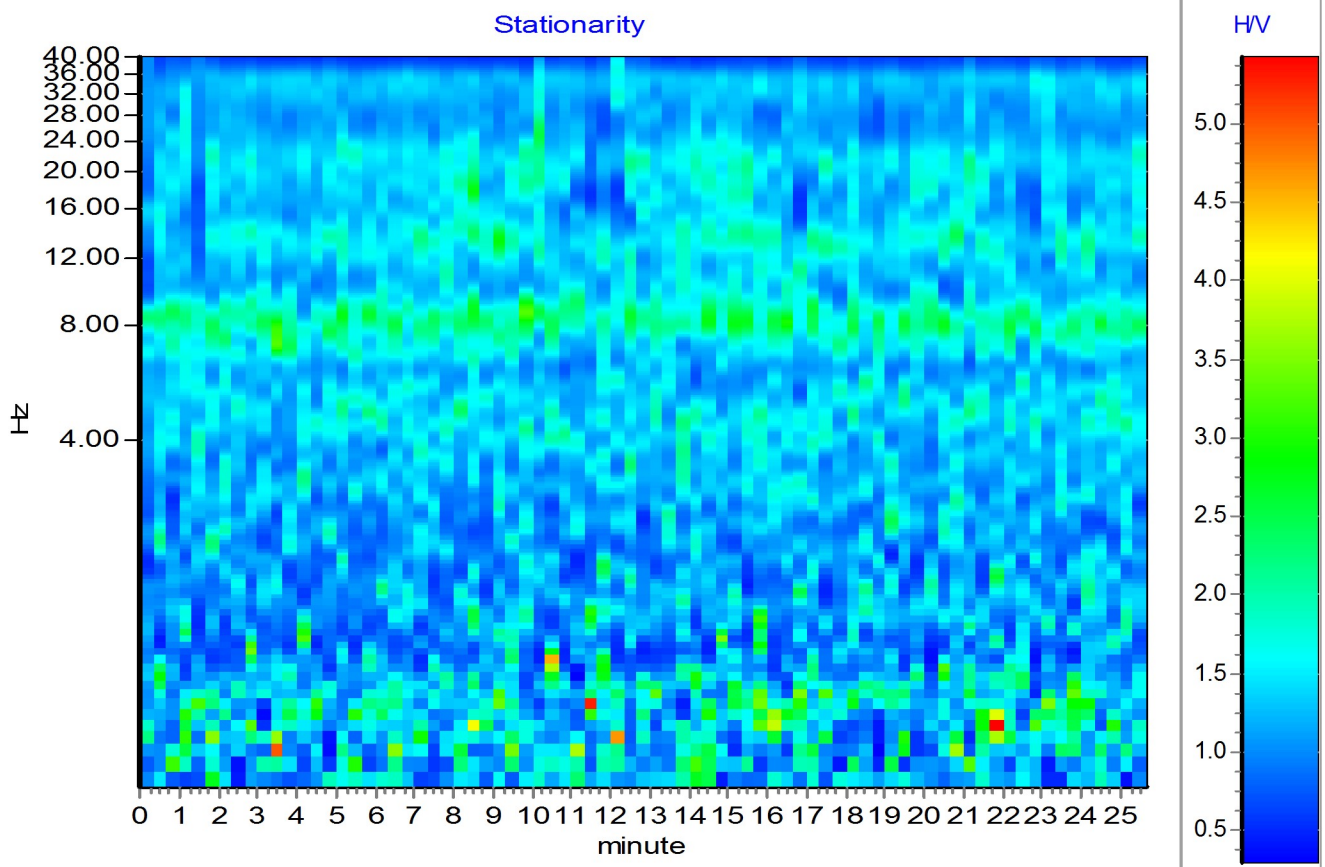
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

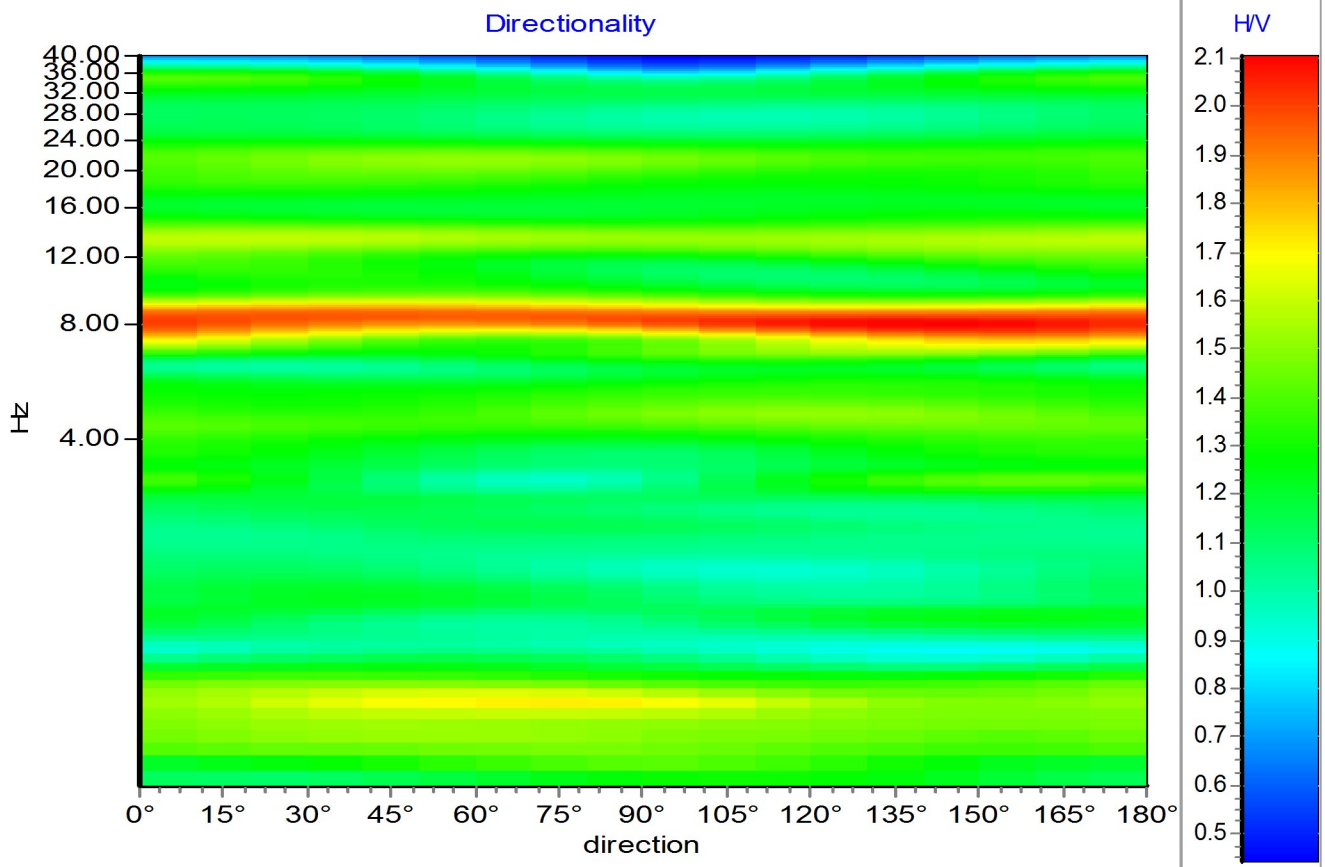
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **4 Monsorbi Pettini**





Misura 5 HVRS

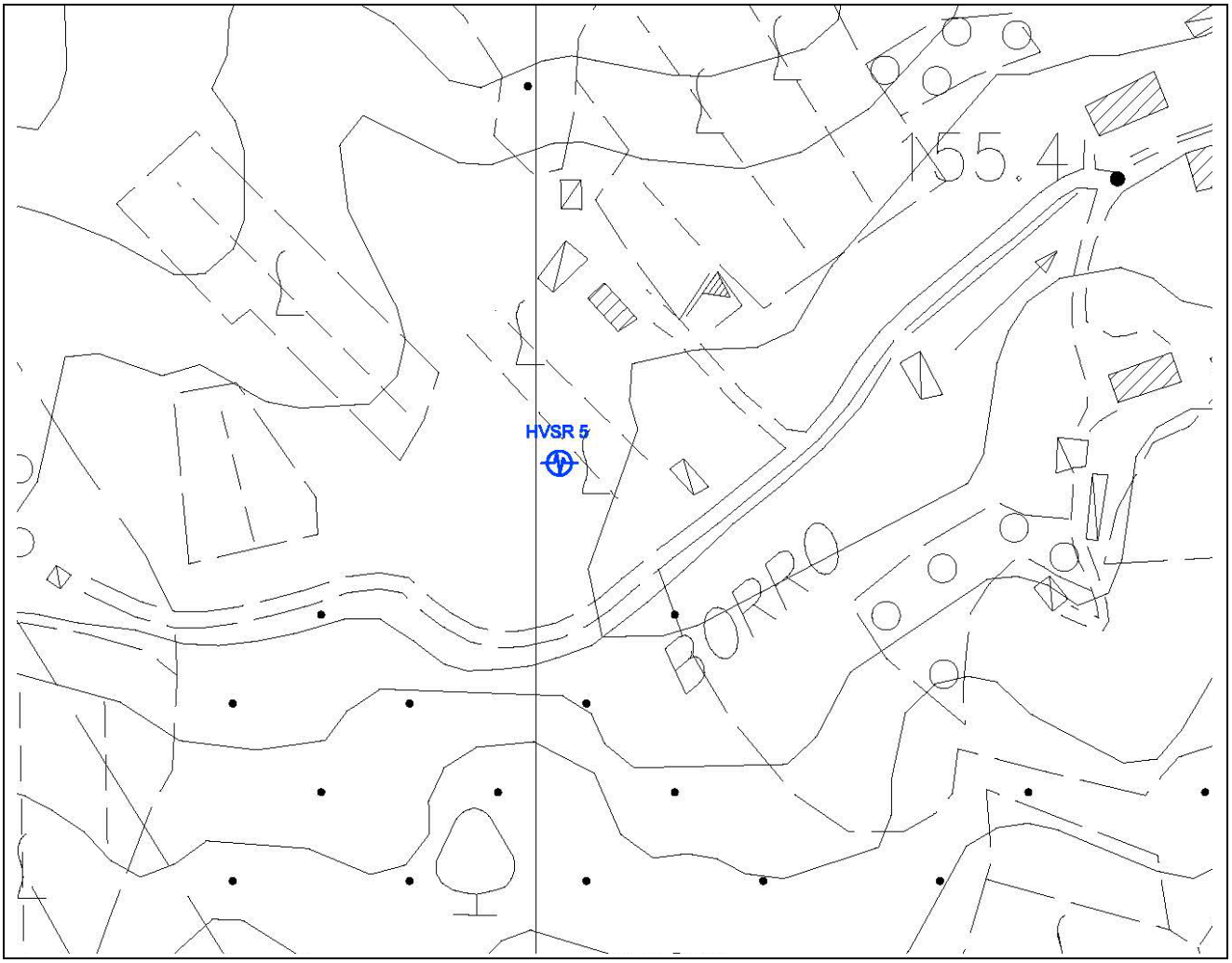


Figura 5.1 – individuazione del sito di studio - scala 1:2.000

Figura 5.2: rilievo sismico

H/V Spectral ratio

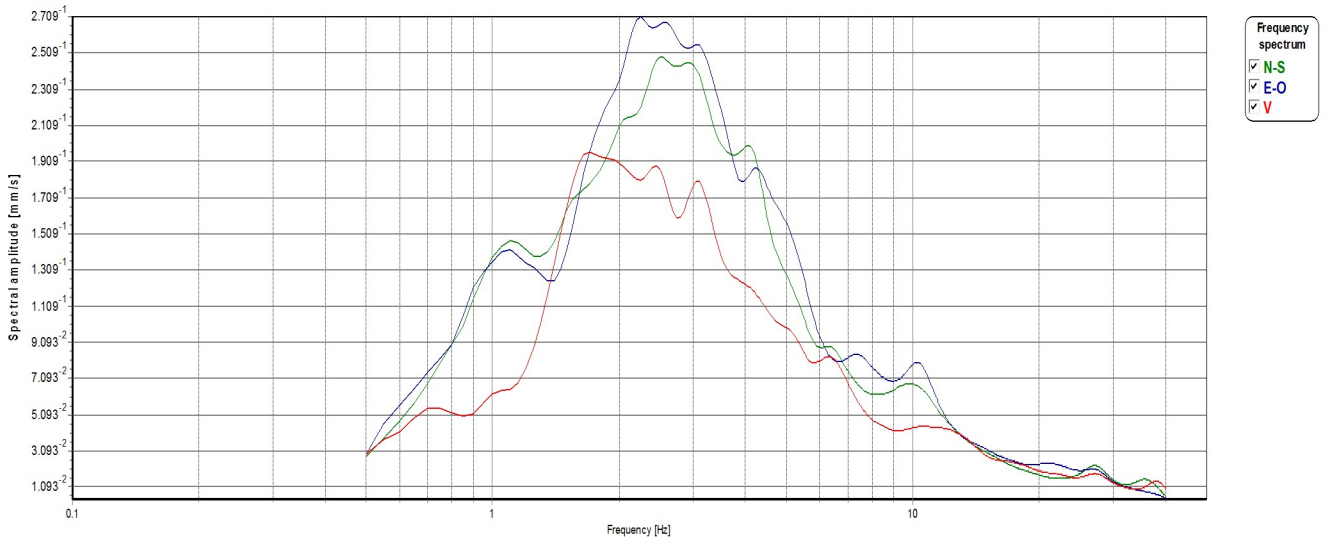
Analysis site: **Montevarchi**

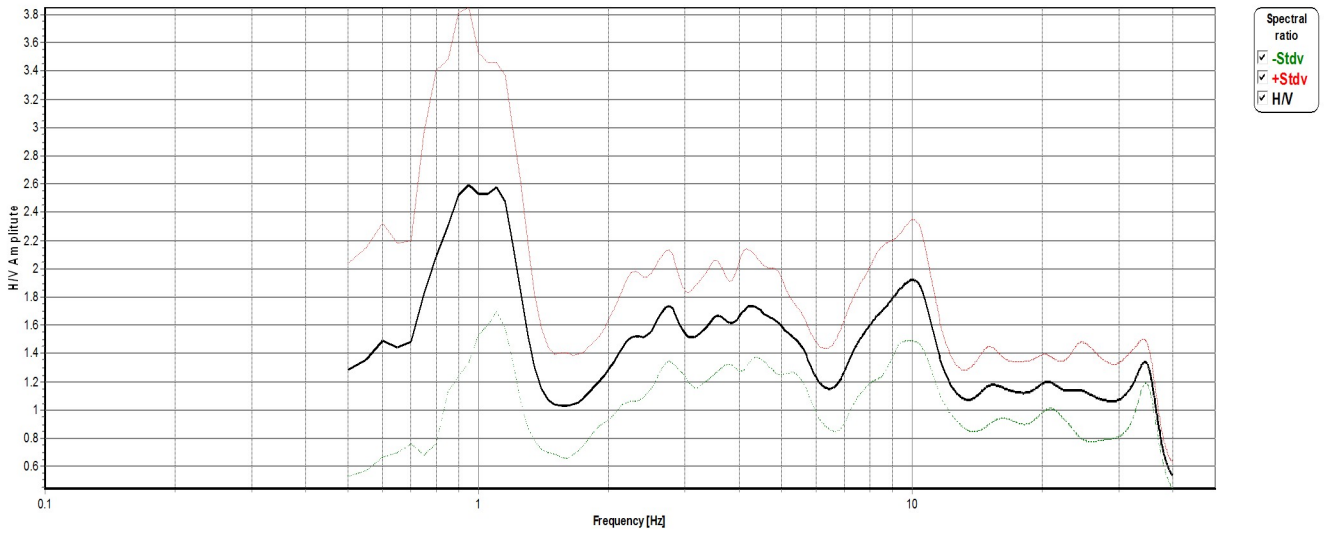
Measure point: **5 Ricasoli**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 12:55:58**
Automatic spike removal:	**No**	Stop recordings:	**14/02/2021 13:30:58**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**72**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**33**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.985**	Standard deviation [Hz]:	**0.134**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **5 Ricasoli**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.99 >= 0.50**	**Yes**
Nc(fø) > 200	**1419.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 30**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.400**	**Yes**
Aø > 2	**2.53 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**11.63% > 5.00%**	**No**
sf < e(fø)	**0.1337 < 0.1478**	**Yes**
sA(fø) < ?(fø)	**0.9992 < 2.0000**	**Yes**

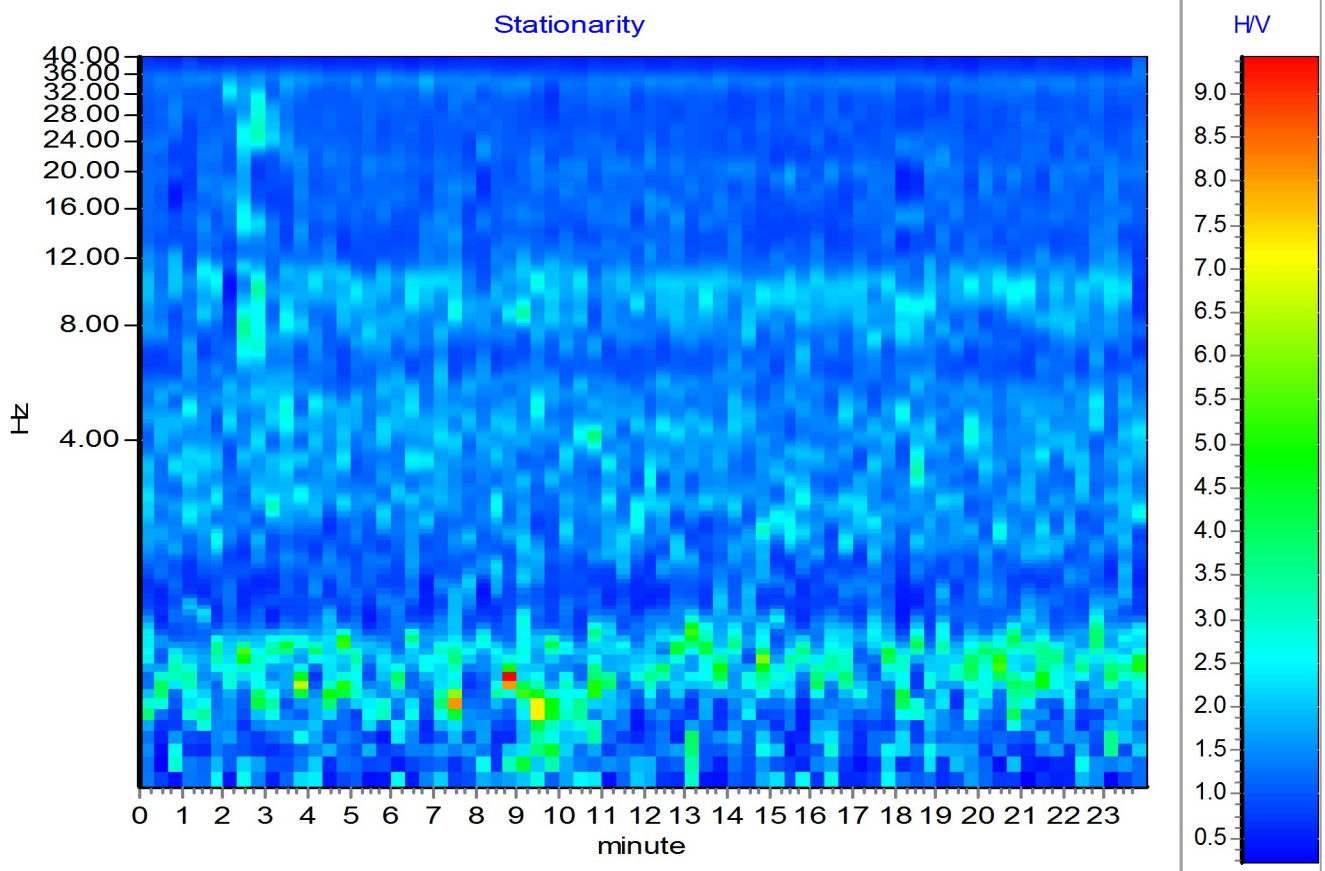
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

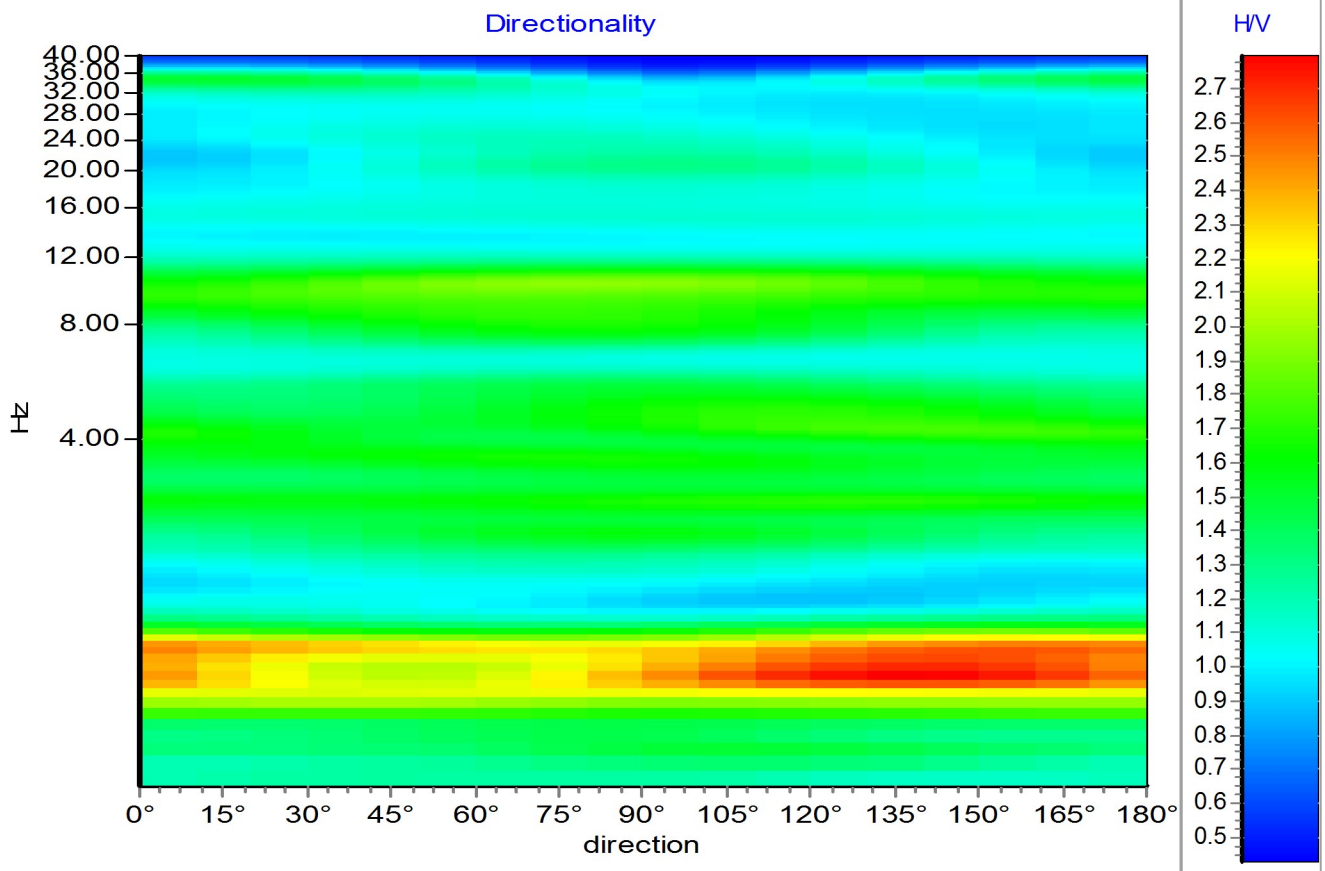
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **5 Ricasoli**





Misura 6 HVRS

Figura 6.1 – individuazione del sito di studio - scala 1:2.000

Figura 6.2: rilievo sismico

H/V Spectral ratio

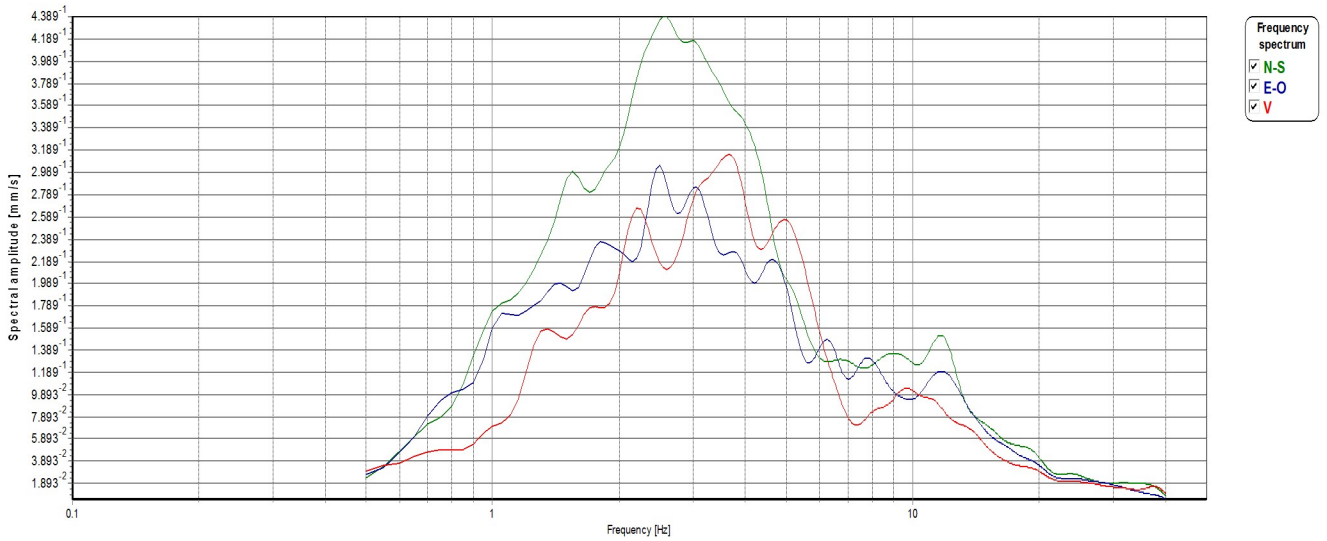
Analysis site: **Montevarchi**

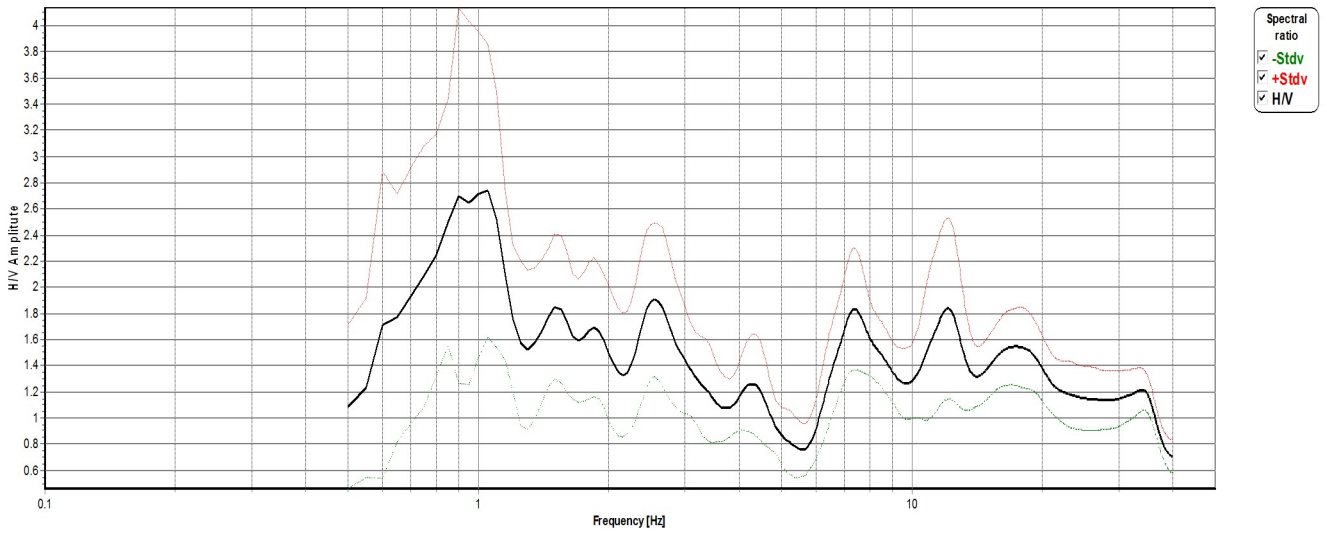
Measure point: **6 Ricasoli**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 13:45:12**
Automatic spike removal:	**No**	Stop recordings:	**18/02/2021 14:20:12**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**66**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**39**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.874**	Standard deviation [Hz]:	**0.164**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **6 Ricasoli**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.87 >= 0.50**	**Yes**
Nc(fø) > 200	**1154.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 25**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**3.300**	**Yes**
Aø > 2	**2.50 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**20.10% > 5.00%**	**No**
sf < e(fø)	**0.1643 > 0.1311**	**No**
sA(fø) < ?(fø)	**0.9399 < 2.0000**	**Yes**

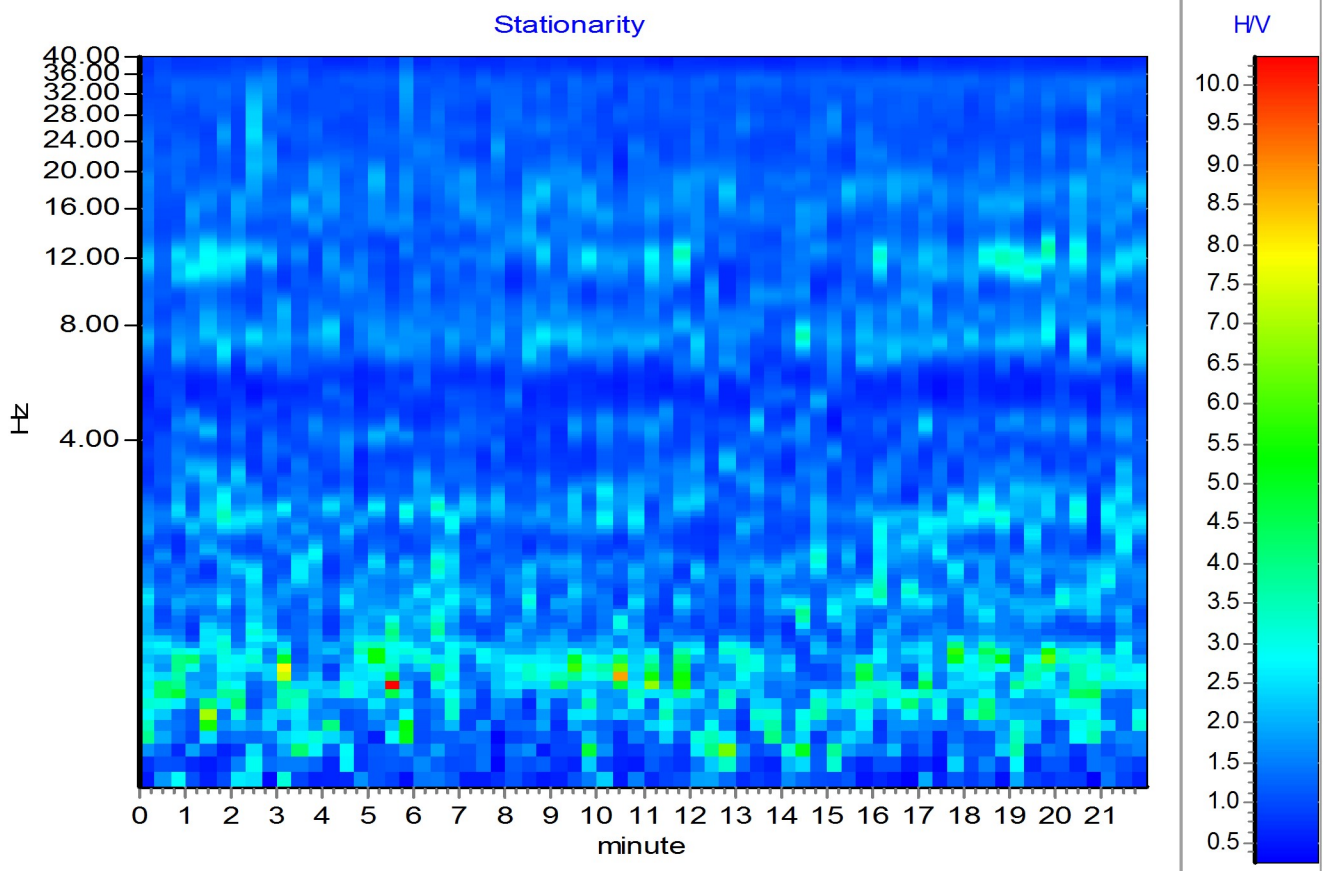
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

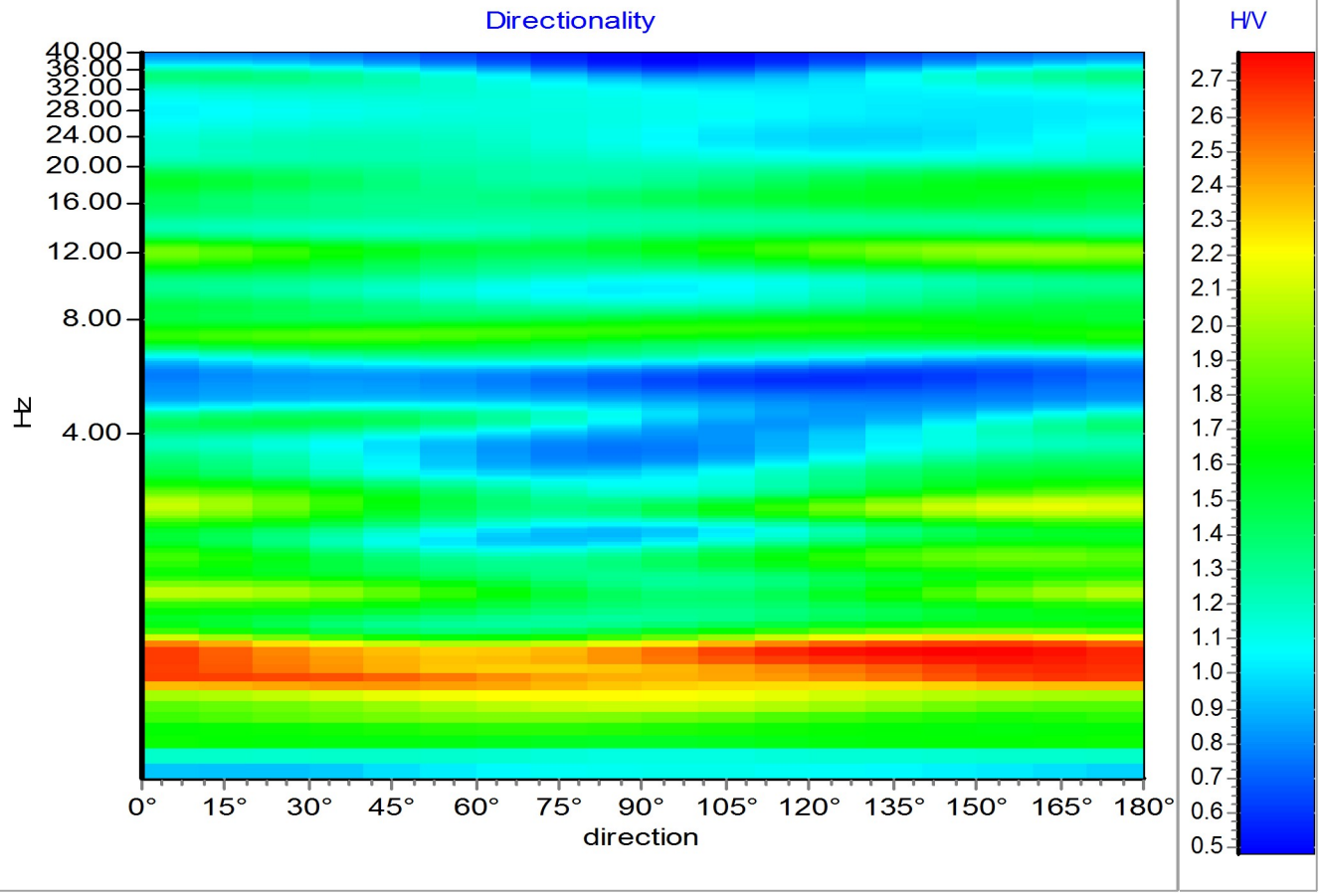
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **6 Ricasoli**





Misura 7 HVRS

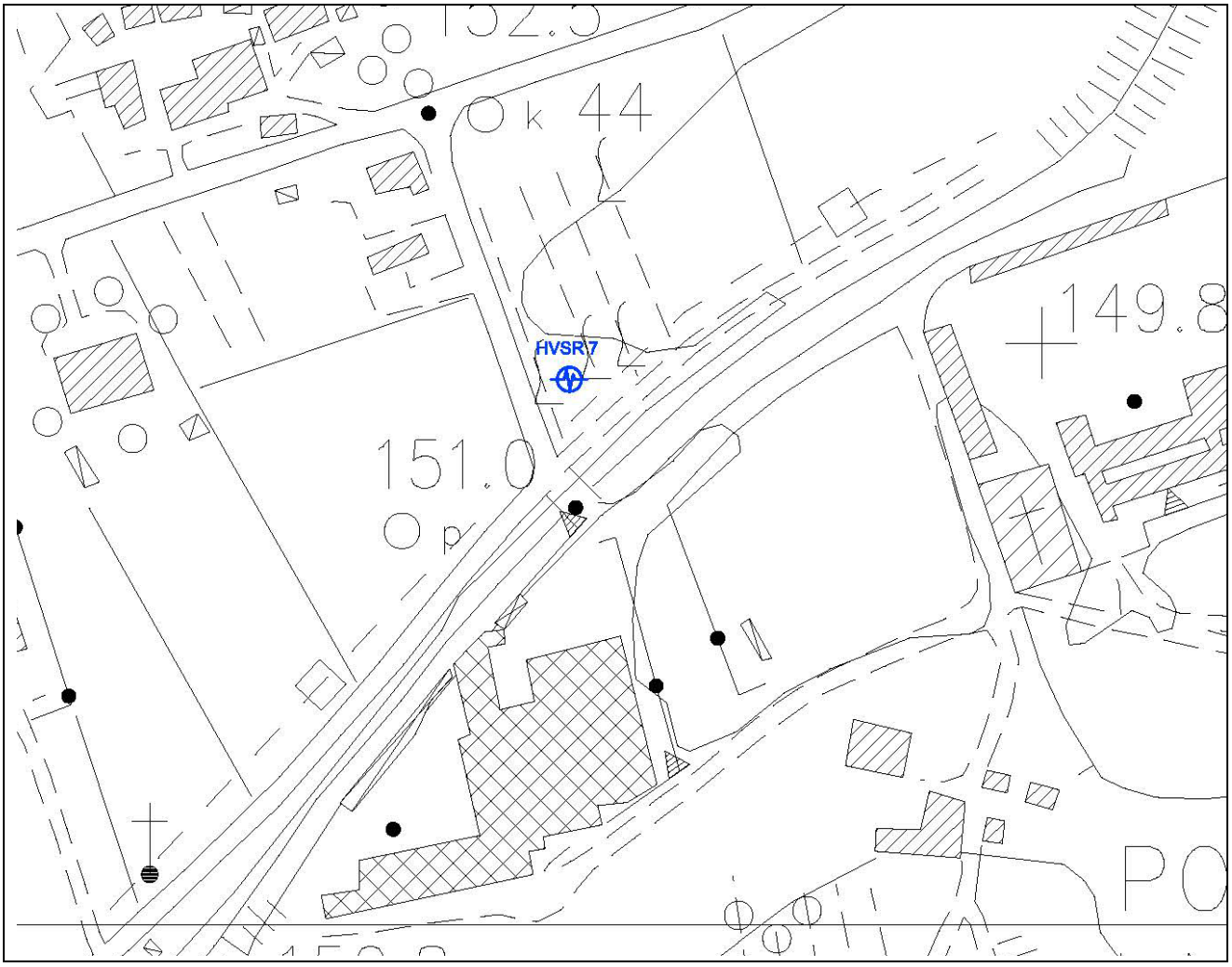


Figura 7.1 – individuazione del sito di studio - scala 1:2.000

Figura 7.2: rilievo sismico

H/V Spectral ratio

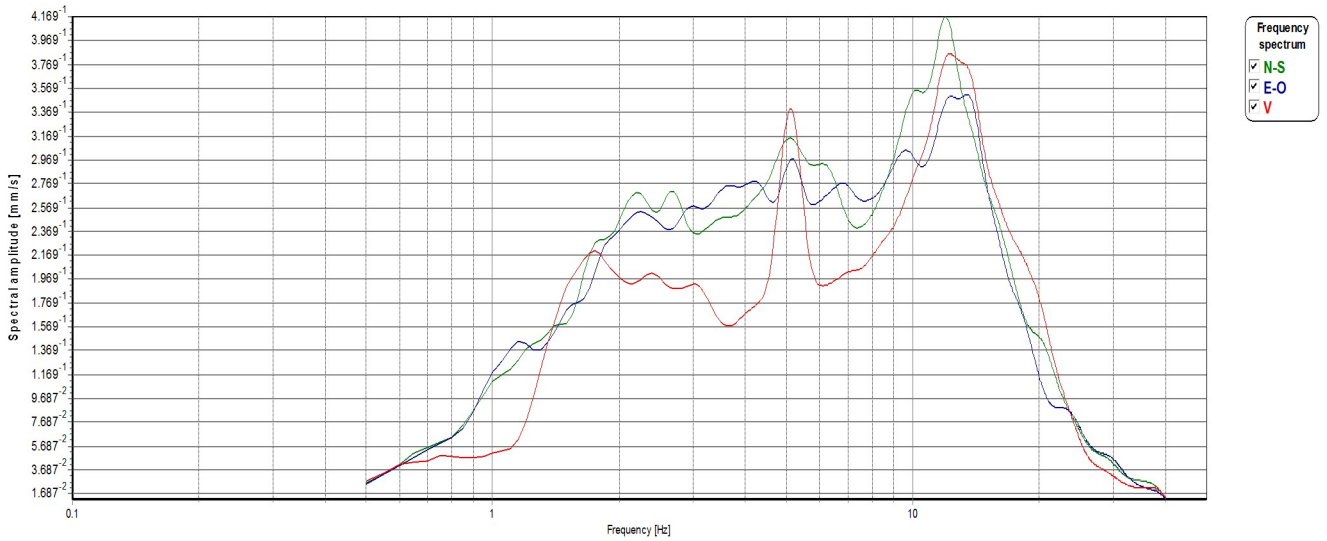
Analysis site: **Montevarchi**

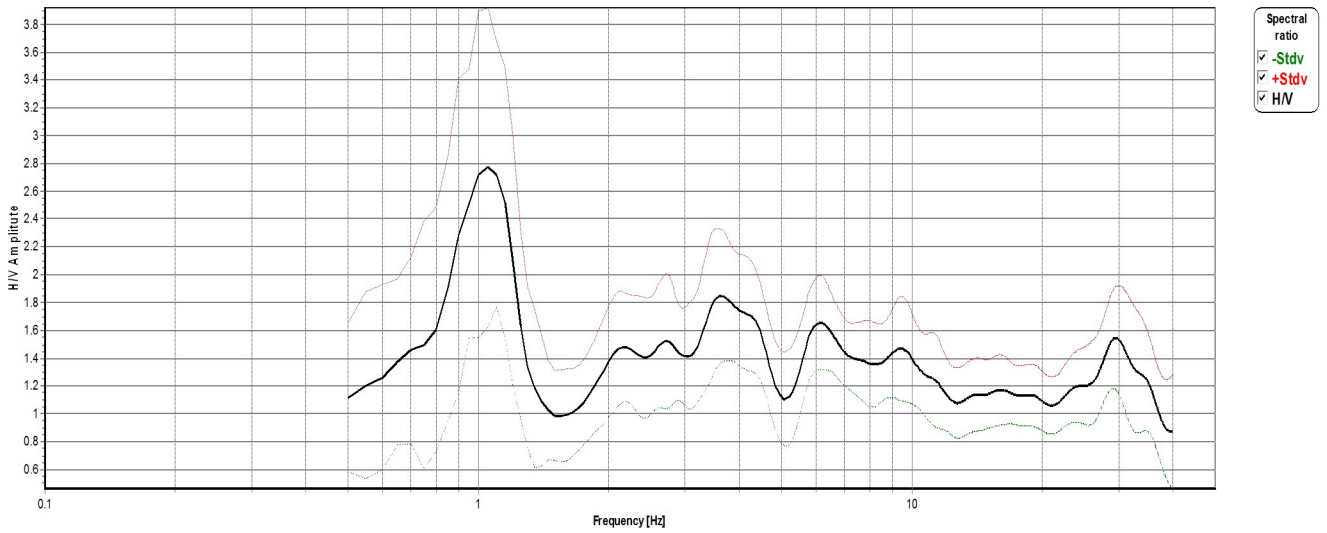
Measure point: **7 Cinatta I**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 14:31:25**
Automatic spike removal:	**No**	Stop recordings:	**18/02/2021 15:06:25**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**60**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**45**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.027**	Standard deviation [Hz]:	**0.121**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **7 Cinatta I**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.03 >= 0.50**	**Yes**
Nc(fø) > 200	**1232.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 31**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.300**	**Yes**
Aø > 2	**2.77 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**7.14% > 5.00%**	**No**
sf < e(fø)	**0.1209 > 0.1027**	**No**
sA(fø) < ?(fø)	**1.1468 < 1.7800**	**Yes**

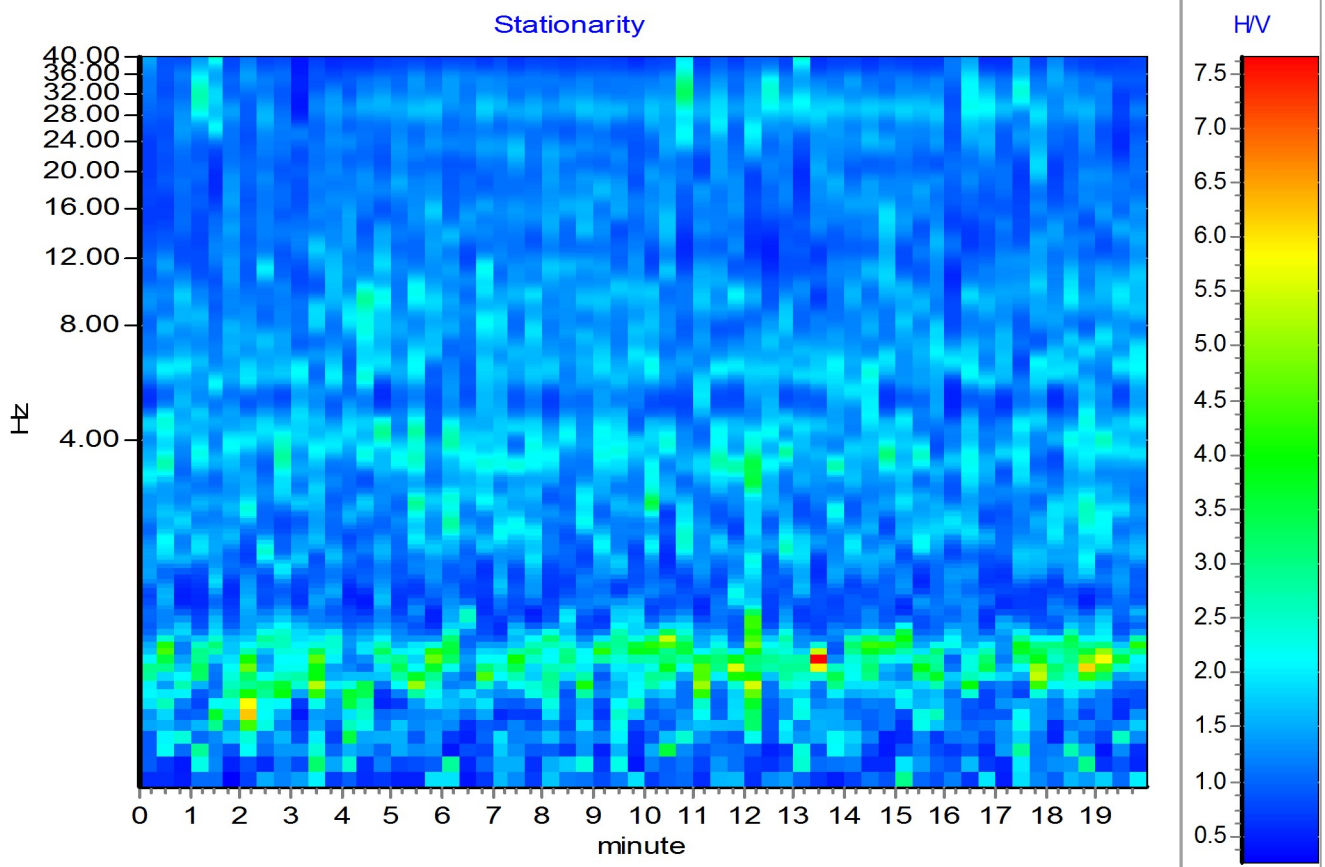
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

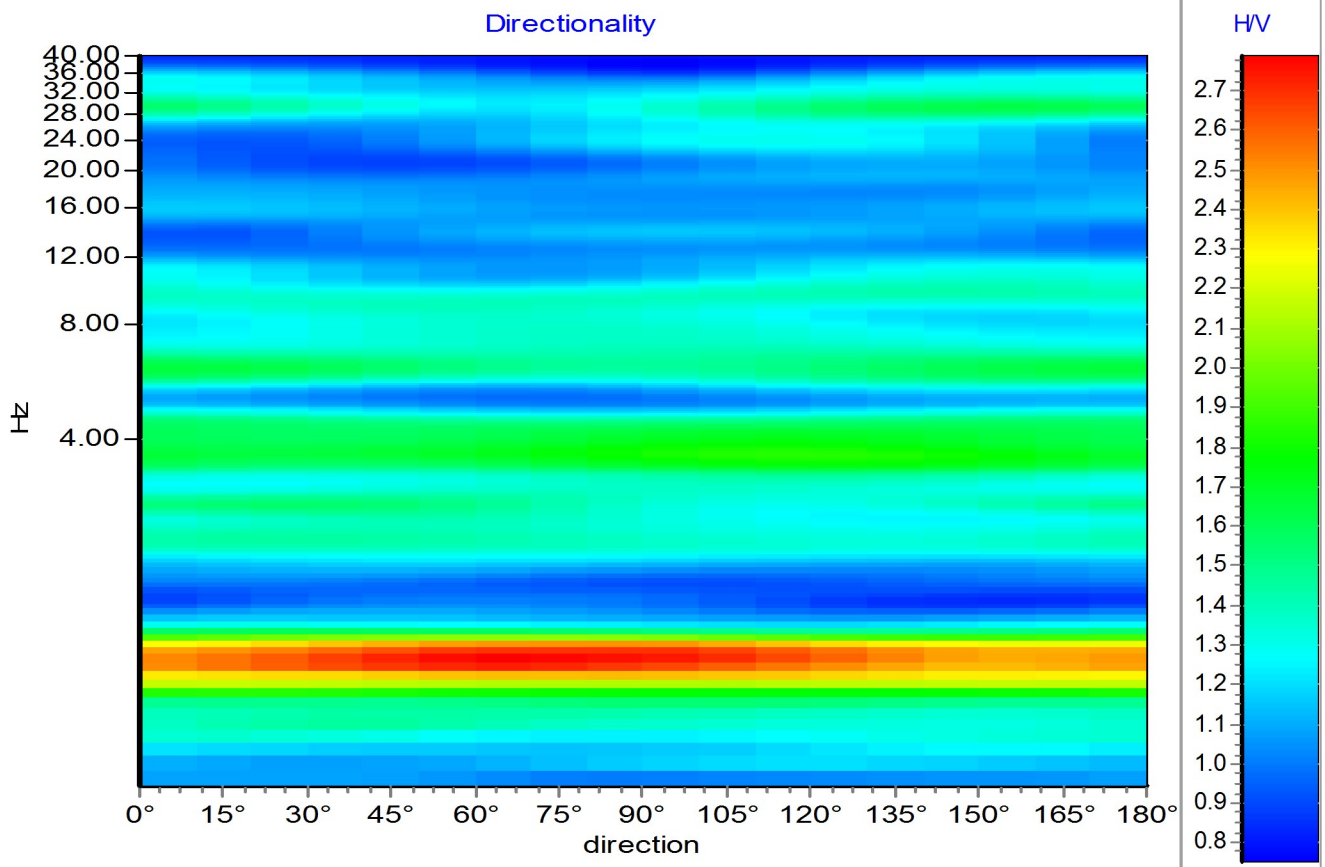
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **7 Cinatta I**





Misura 8 HVRS

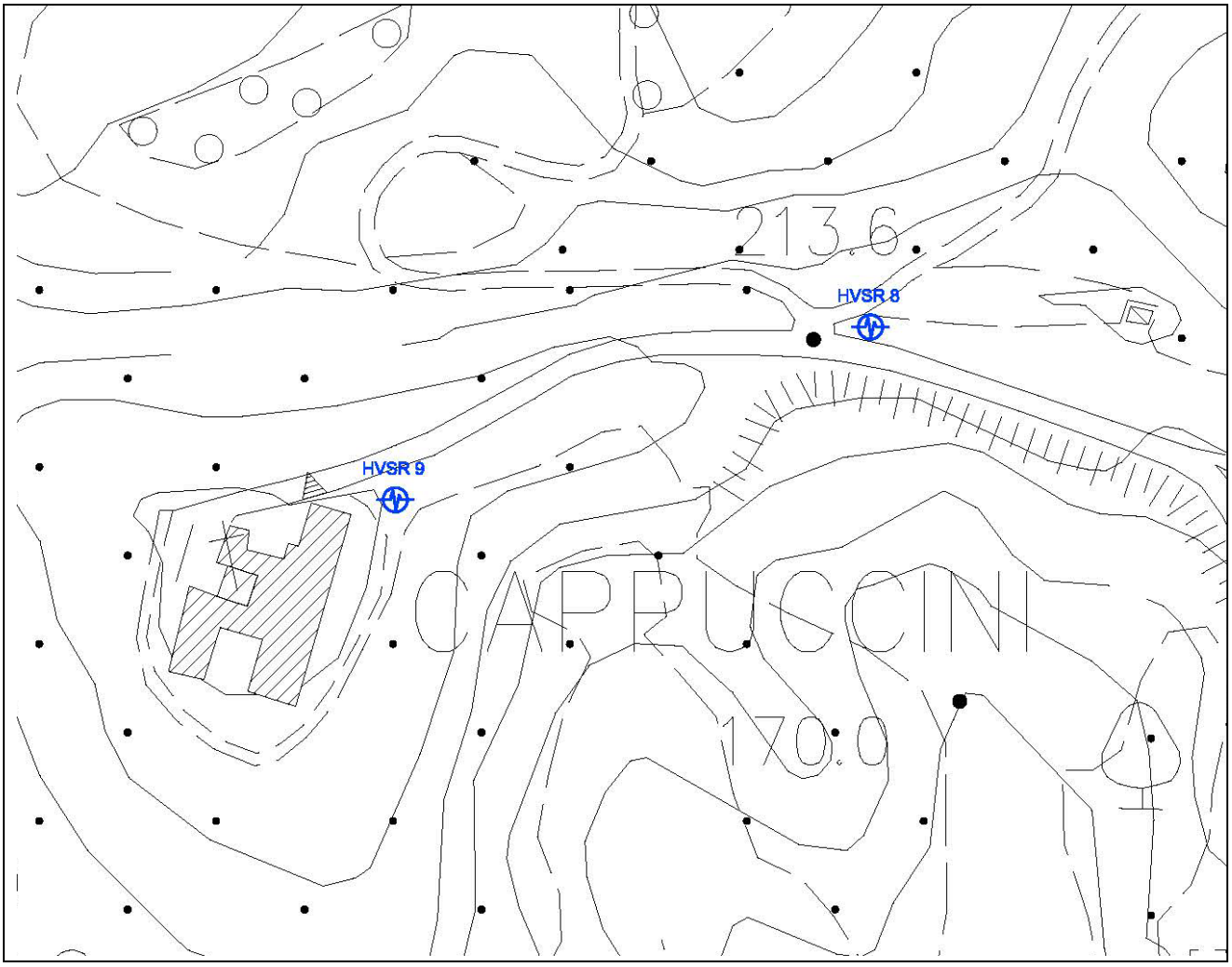


Figura 8.1 – individuazione del sito di studio - scala 1:2.000

Figura 8.2: rilievo sismico

H/V Spectral ratio

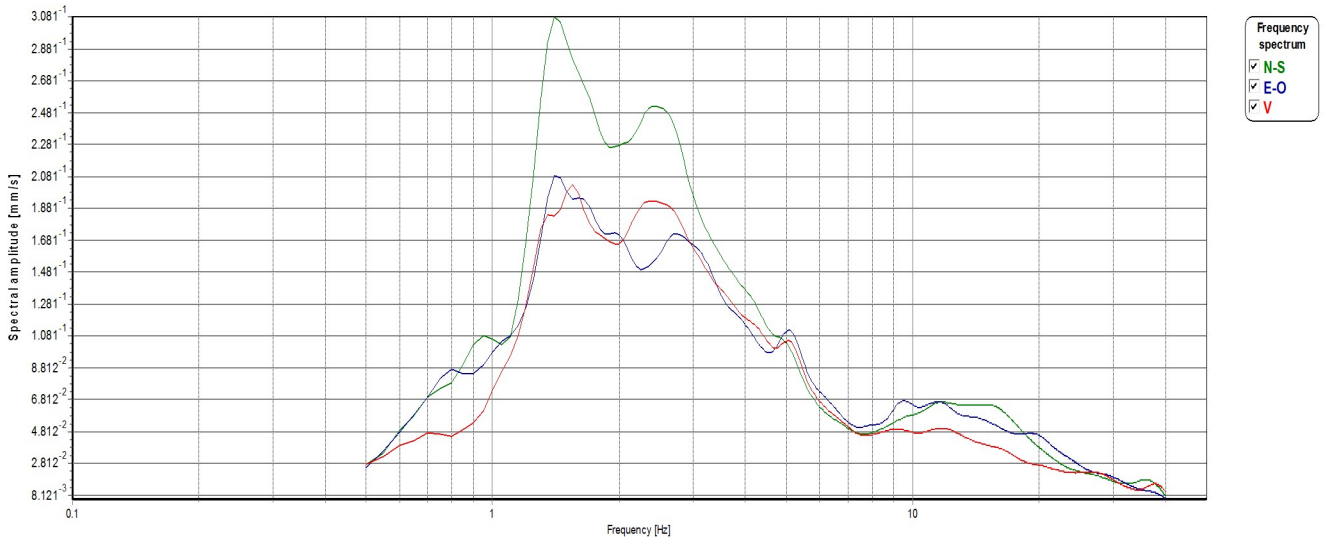
Analysis site: **Montevarchi**

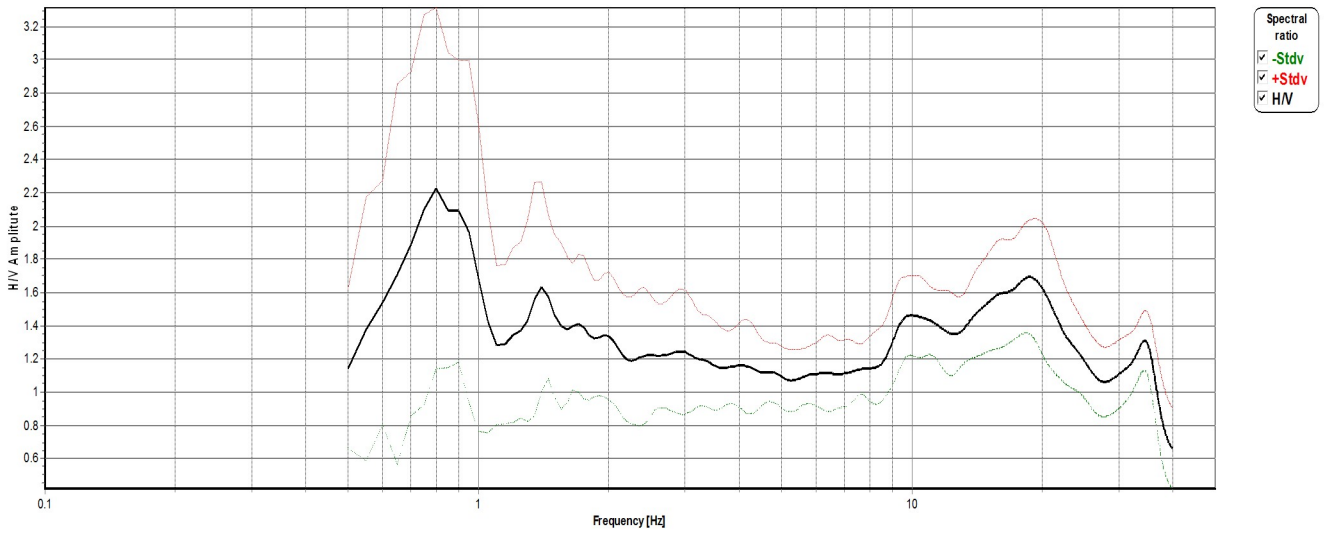
Measure point: **8 Cappuccini**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 15:17:59**
Automatic spike removal:	**No**	Stop recordings:	**18/02/2021 15:47:59**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**57**
Lw Windows [s]:	**20**	Recording length [s]:	**1800**
Overlap Windows s]:	**0.0**	Discarded windows:	**33**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.802**	Standard deviation [Hz]:	**0.118**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **8 Cappuccini**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.80 >= 0.50**	**Yes**
Nc(fø) > 200	**914.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 23**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**2.23 > 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**2188.70% > 5.00%**	**No**
sf < e(fø)	**0.1181 < 0.1203**	**Yes**
sA(fø) < ?(fø)	**1.0861 < 2.0000**	**Yes**

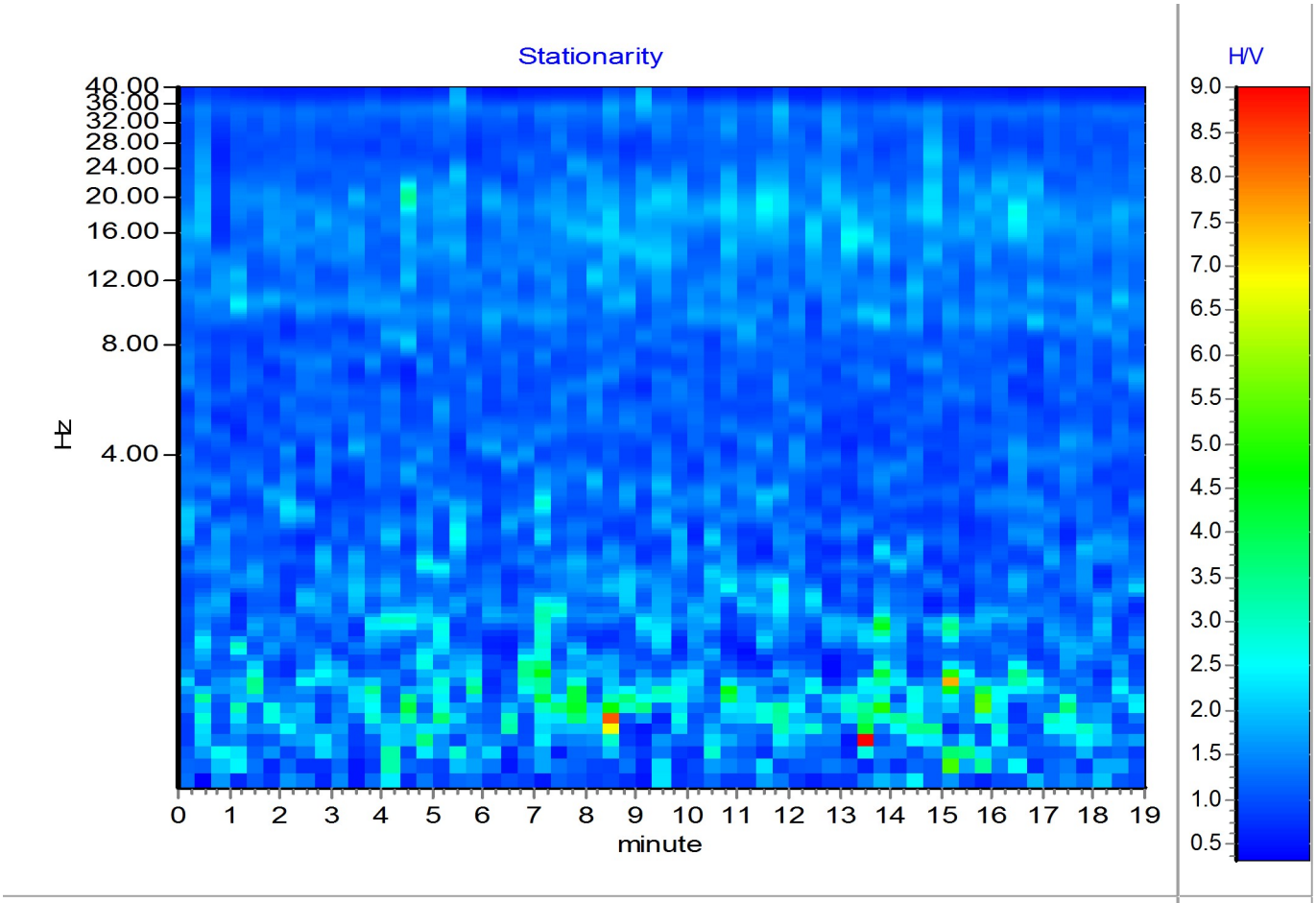
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

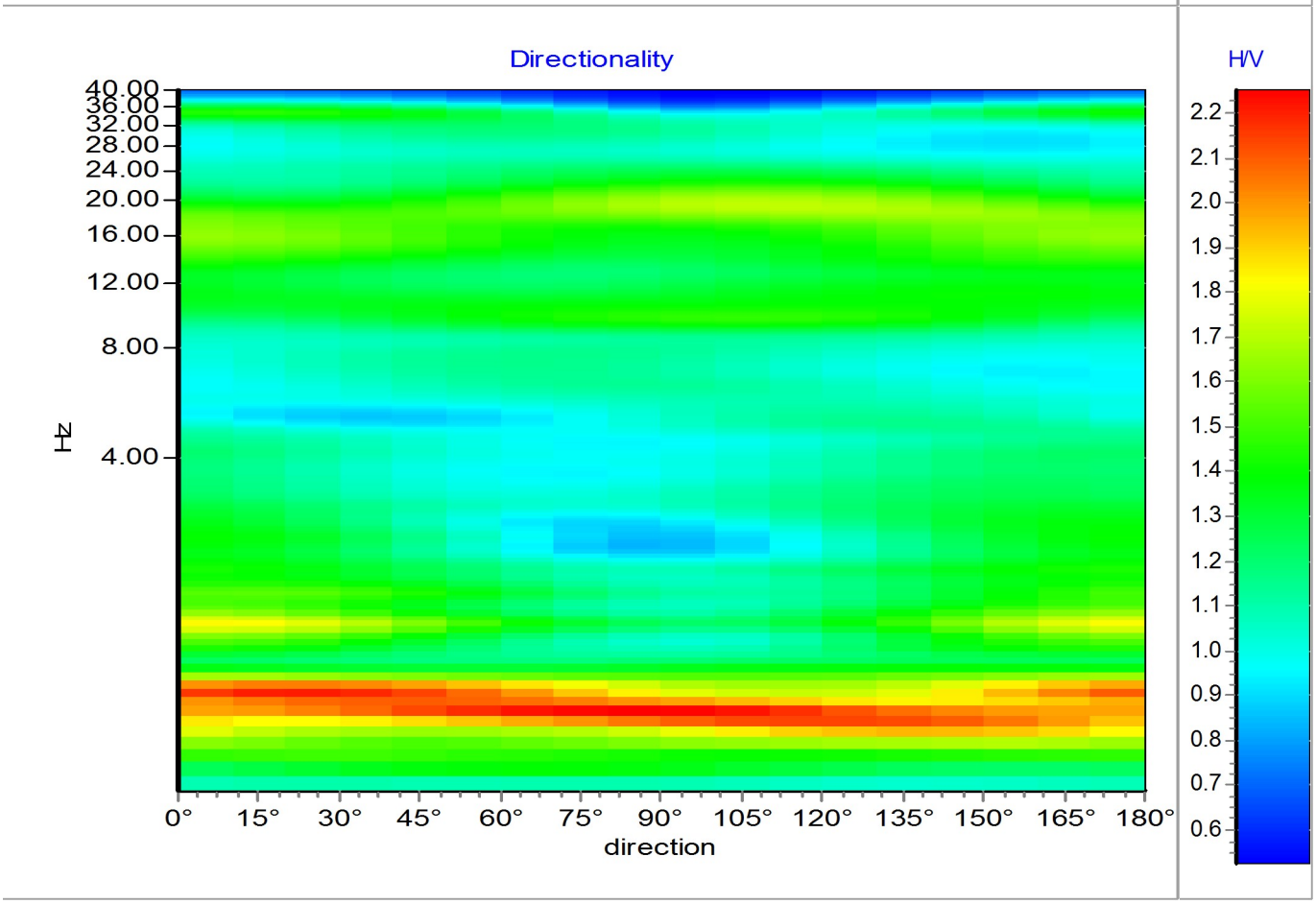
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **8 Cappuccini**





Misura 9 HVRS

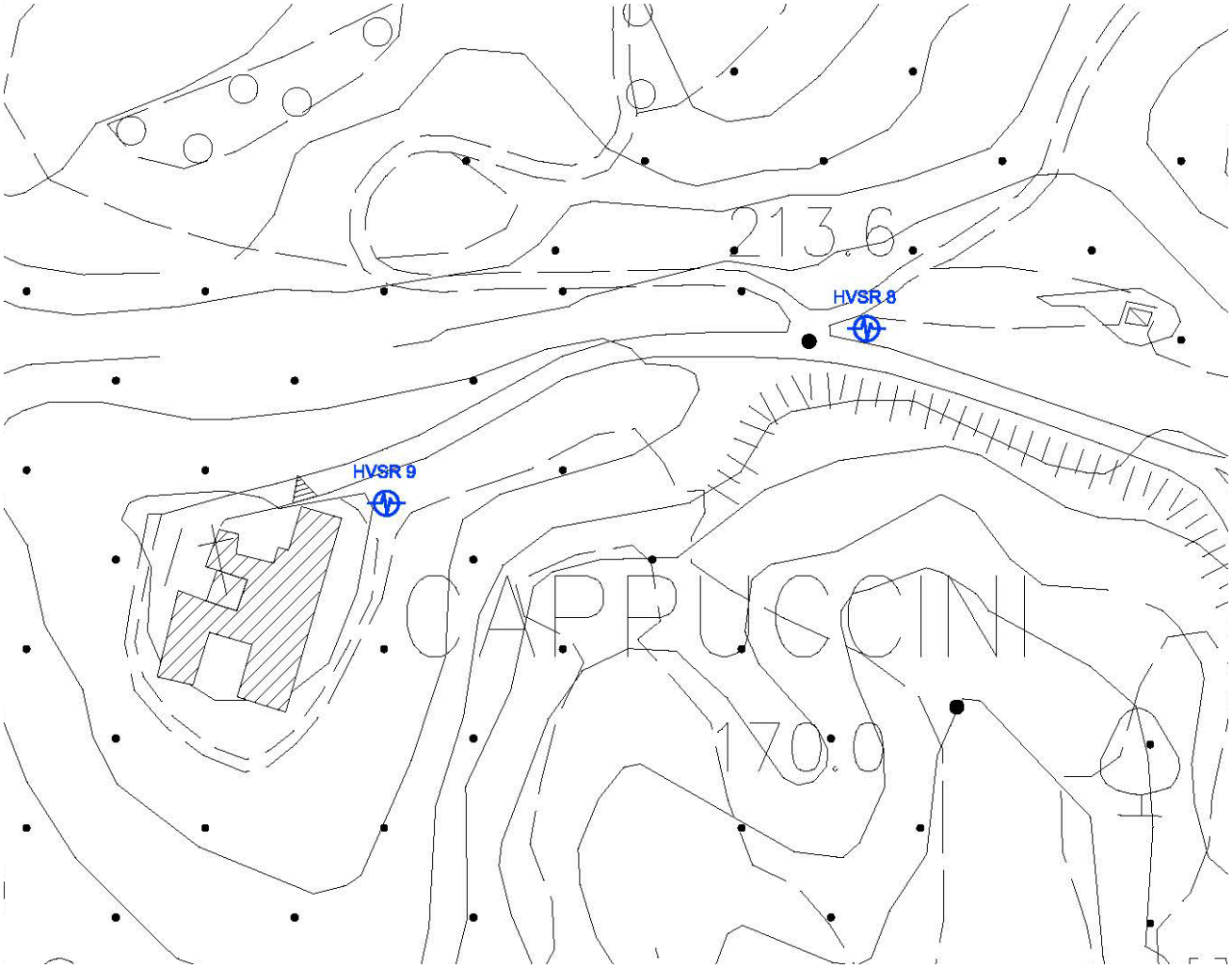


Figura 9.1 – individuazione del sito di studio - scala 1:1000

Figura 9.2: rilievo sismico

H/V Spectral ratio

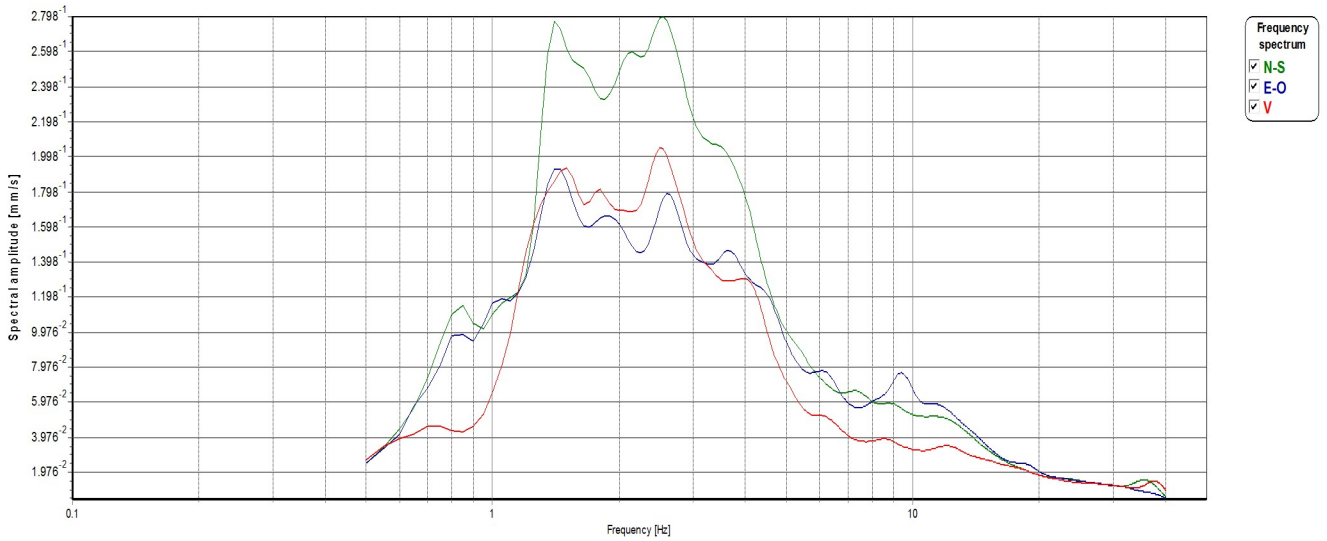
Analysis site: **Montevarchi**

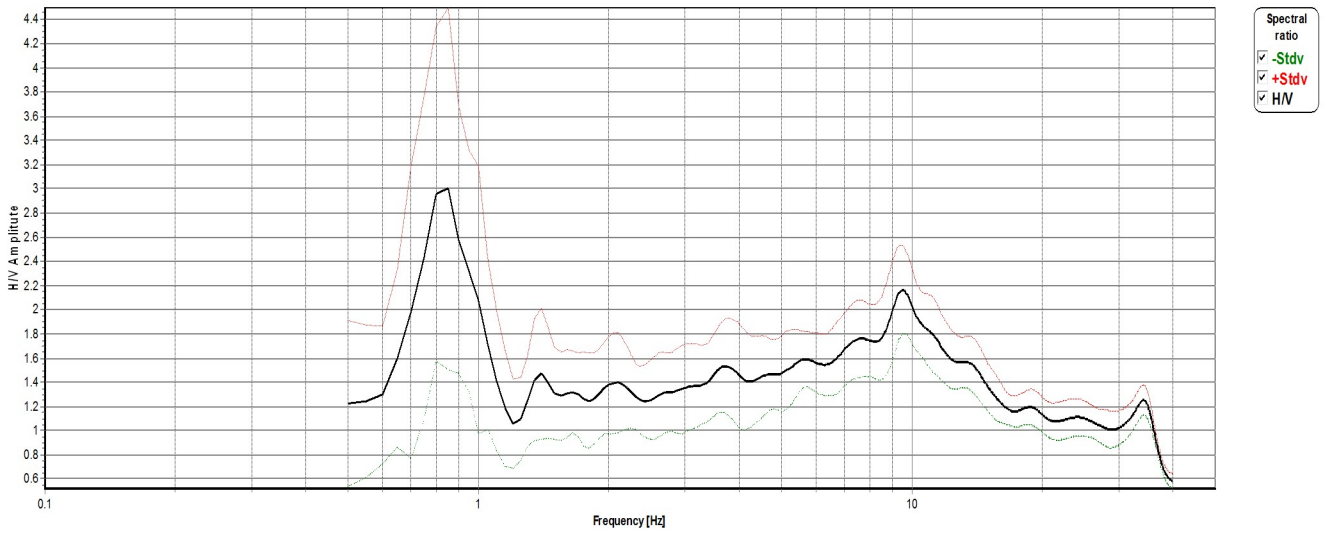
Measure point: **9 Cappuccini**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 15:57:33**
Automatic spike removal:	**No**	Stop recordings:	**18/02/2021 16:32:33**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**61**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**44**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.842**	Standard deviation [Hz]:	**0.097**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **9 Cappuccini**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.84 >= 0.50**	**Yes**
Nc(fø) > 200	**1027.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 24**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.100**	**Yes**
Aø > 2	**3.00 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**1040.40% > 5.00%**	**No**
sf < e(fø)	**0.0967 < 0.1263**	**Yes**
sA(fø) < ?(fø)	**1.4950 < 2.0000**	**Yes**

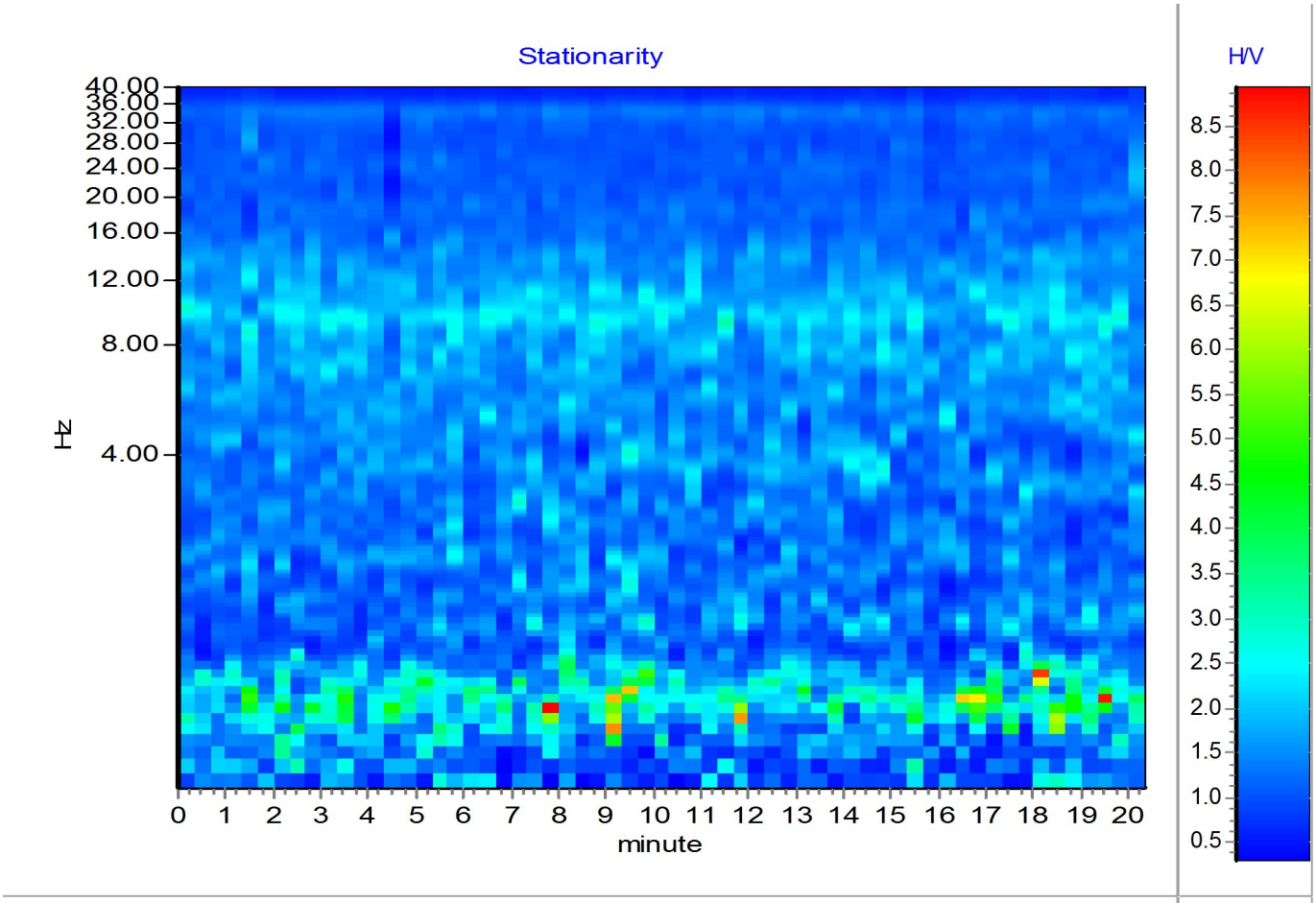
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

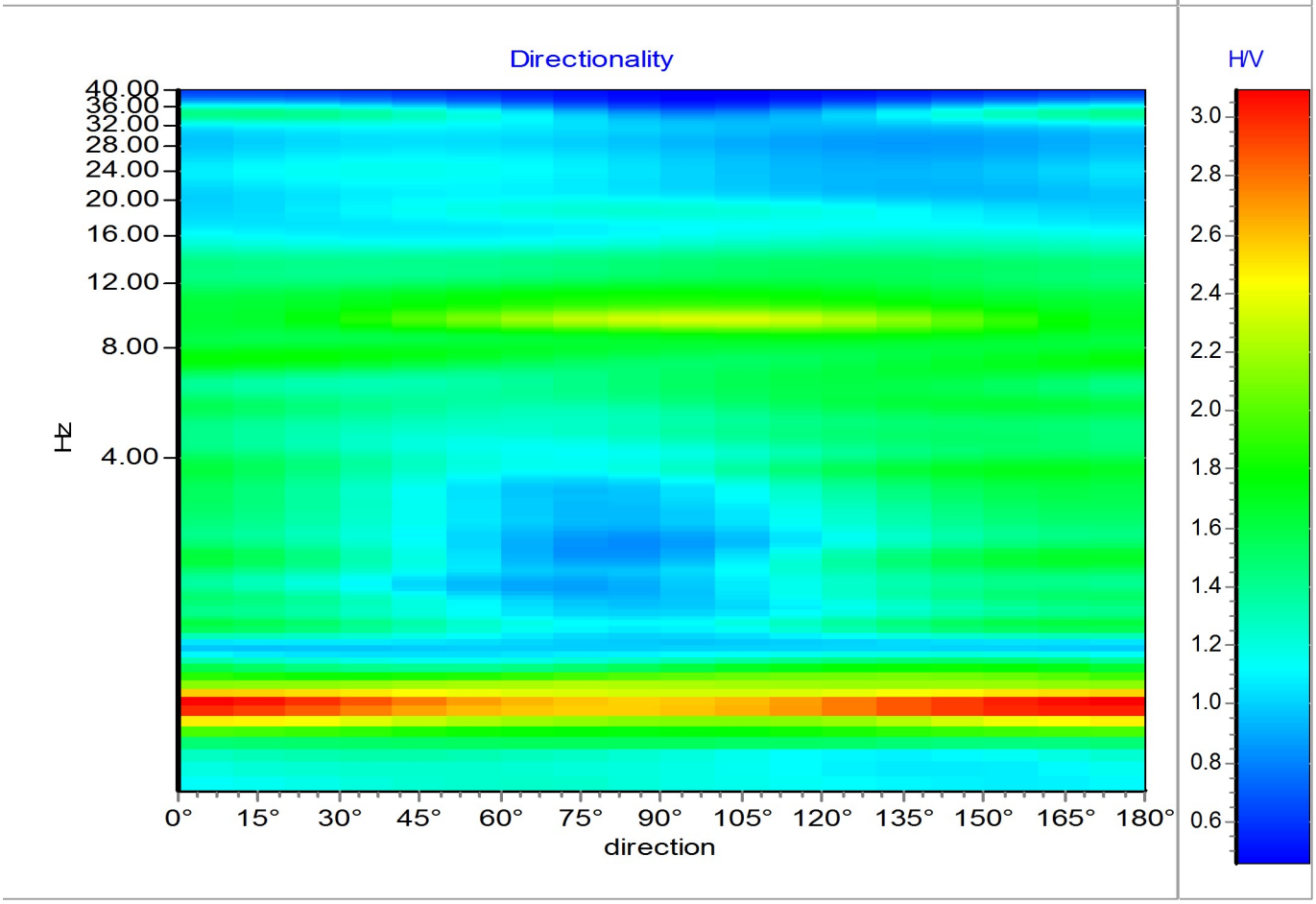
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **9 Cappuccini**





Misura 10 HVRS

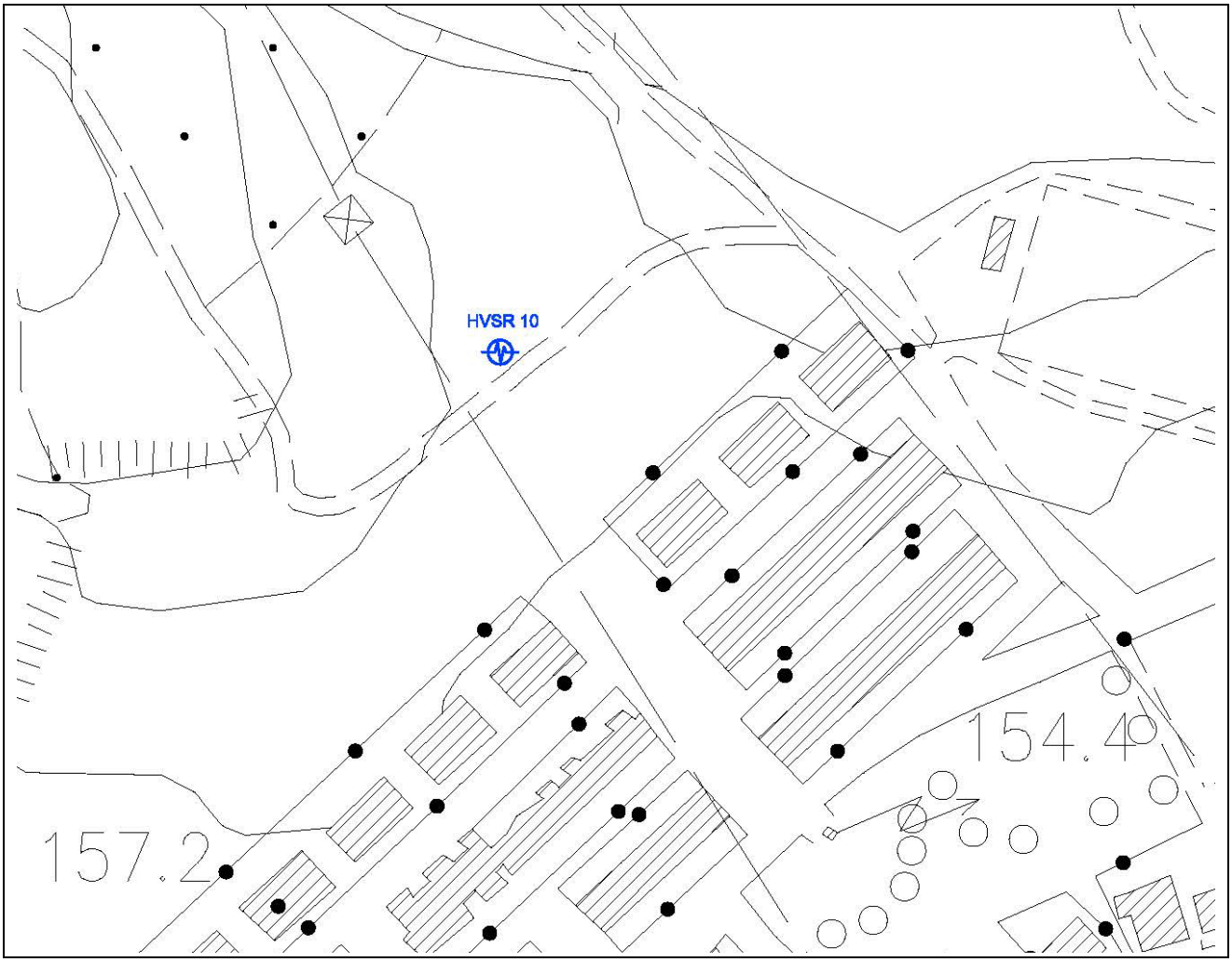


Figura 10.1 – individuazione del sito di studio - scala 1:2.000

Figura 10.2: rilievo sismico

H/V Spectral ratio

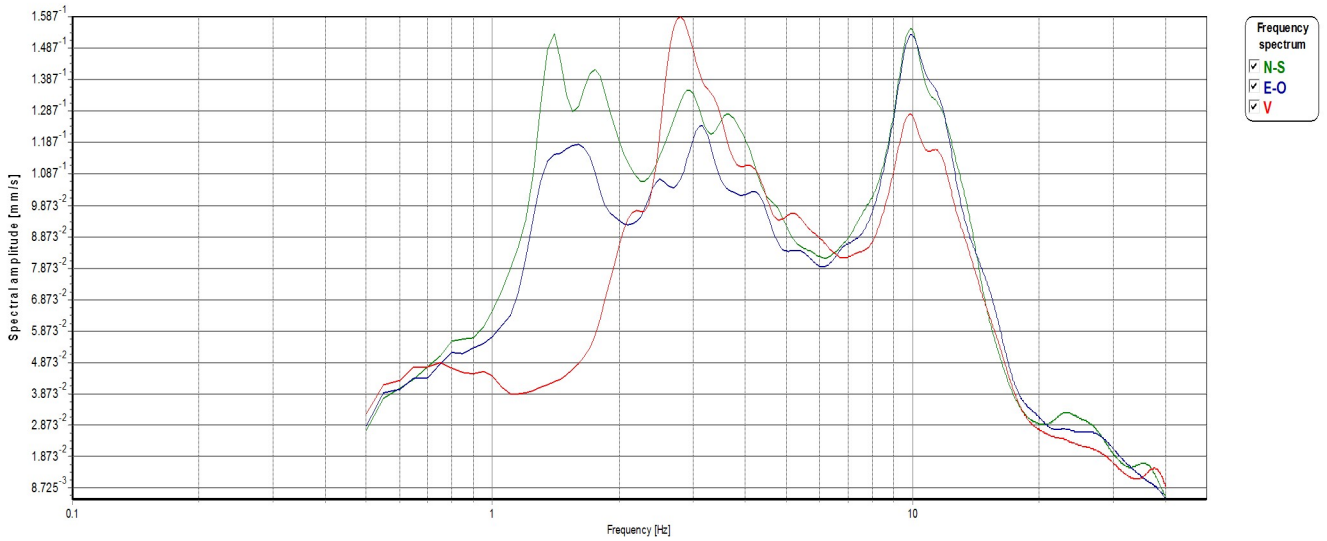
Analysis site: **Montevarchi**

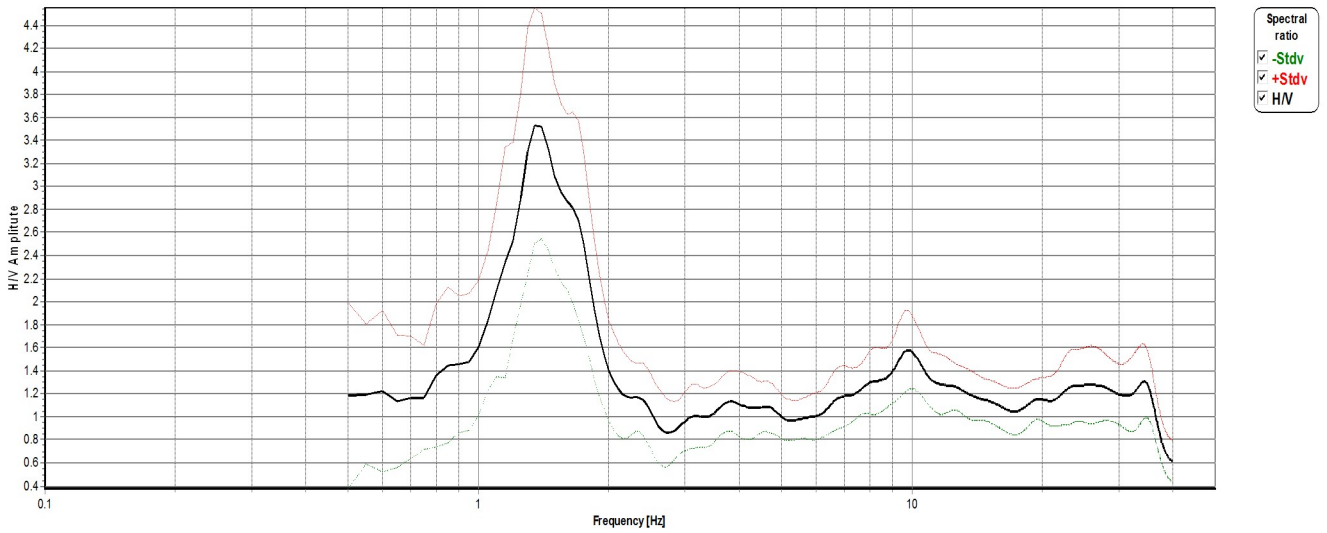
Measure point: **10 Leolini**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 16:44:48**
Automatic spike removal:	**No**	Stop recordings:	**18/02/2021 17:14:48**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**78**
Lw Windows [s]:	**20**	Recording length [s]:	**1800**
Overlap Windows s]:	**0.0**	Discarded windows:	**12**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.421**	Standard deviation [Hz]:	**0.160**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **10 Leolini**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.42 >= 0.50**	**Yes**
Nc(fø) > 200	**2217.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 42**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.900**	**Yes**
Aø > 2	**3.52 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**5.01% > 5.00%**	**No**
sf < e(fø)	**0.1596 > 0.1421**	**No**
sA(fø) < ?(fø)	**0.9787 < 1.7800**	**Yes**

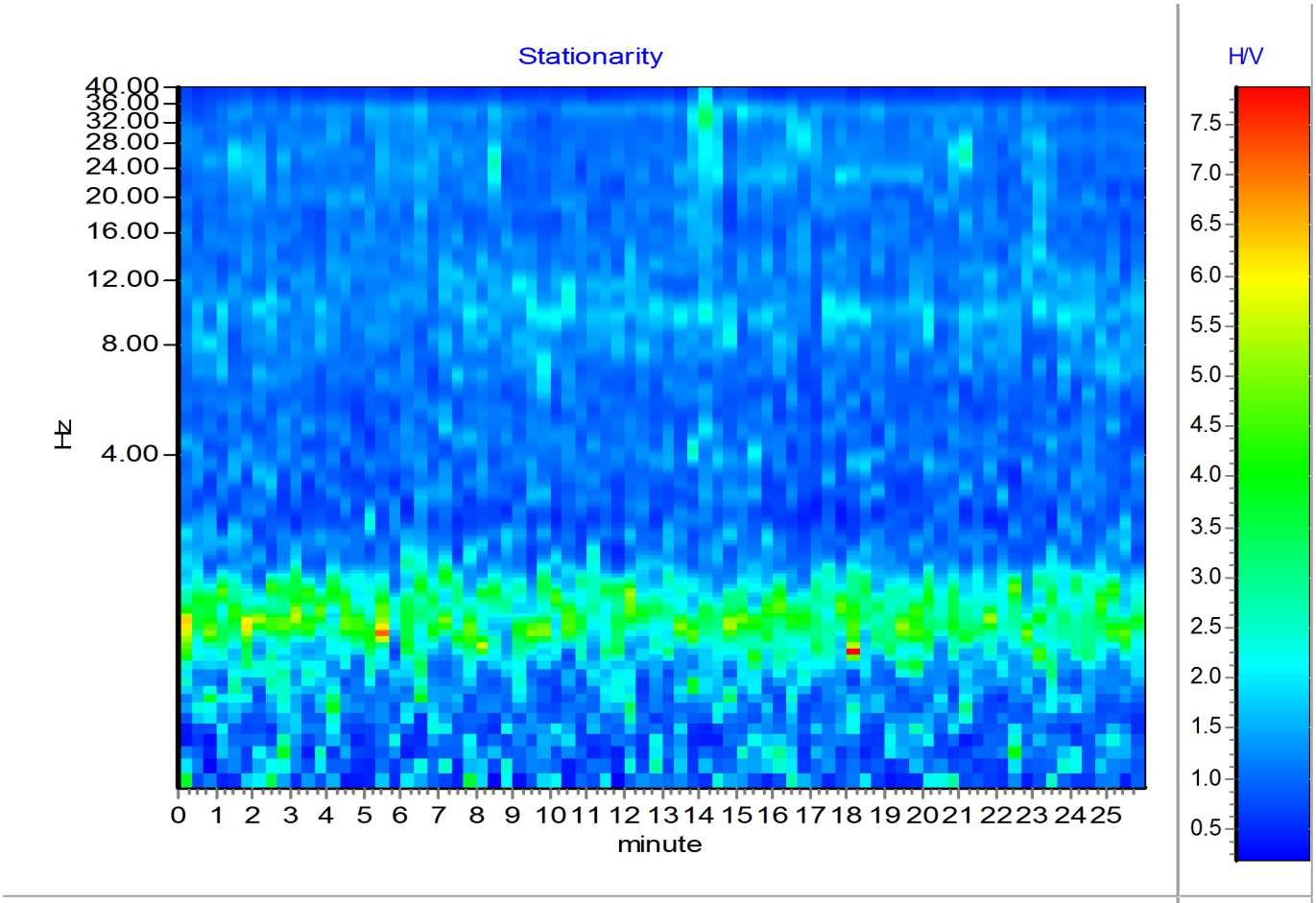
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

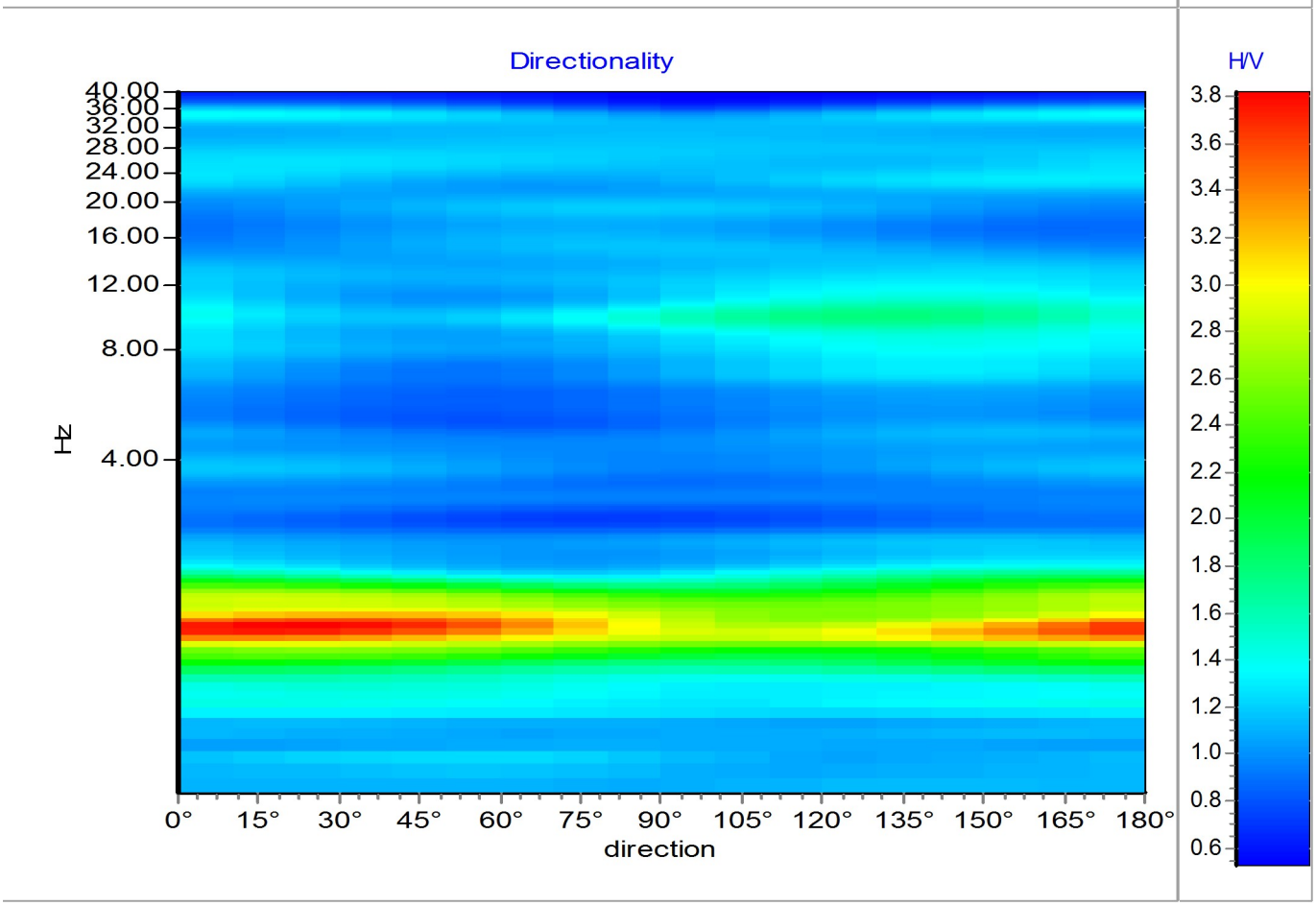
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **10 Leolini**





Misura 11 HVRS

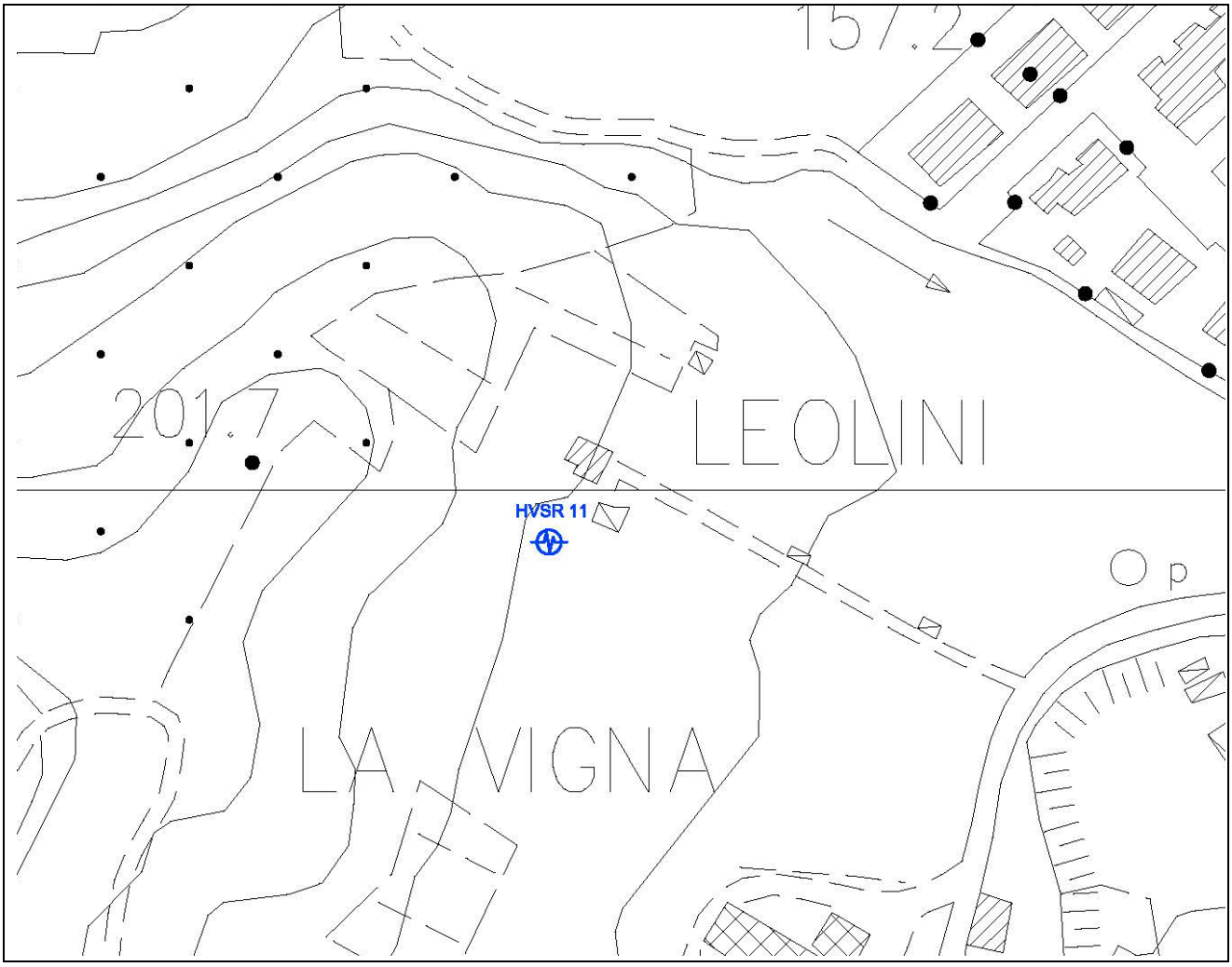


Figura 11.1 – individuazione del sito di studio - scala 1:2.000

Figura 11.2: rilievo sismico

H/V Spectral ratio

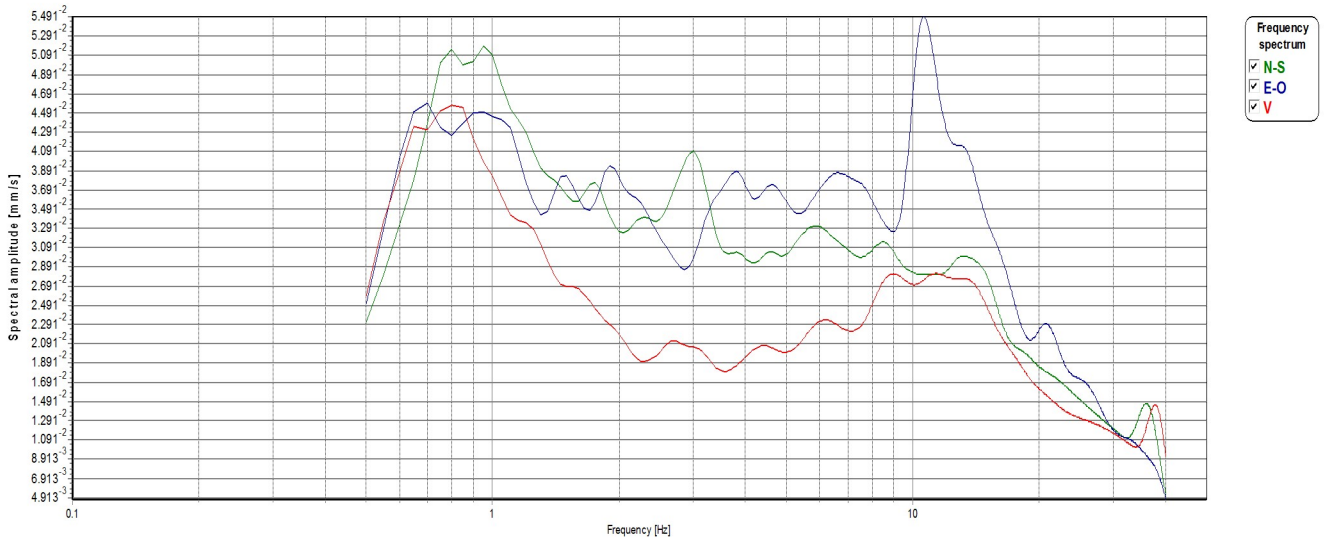
Analysis site: **Montevarchi**

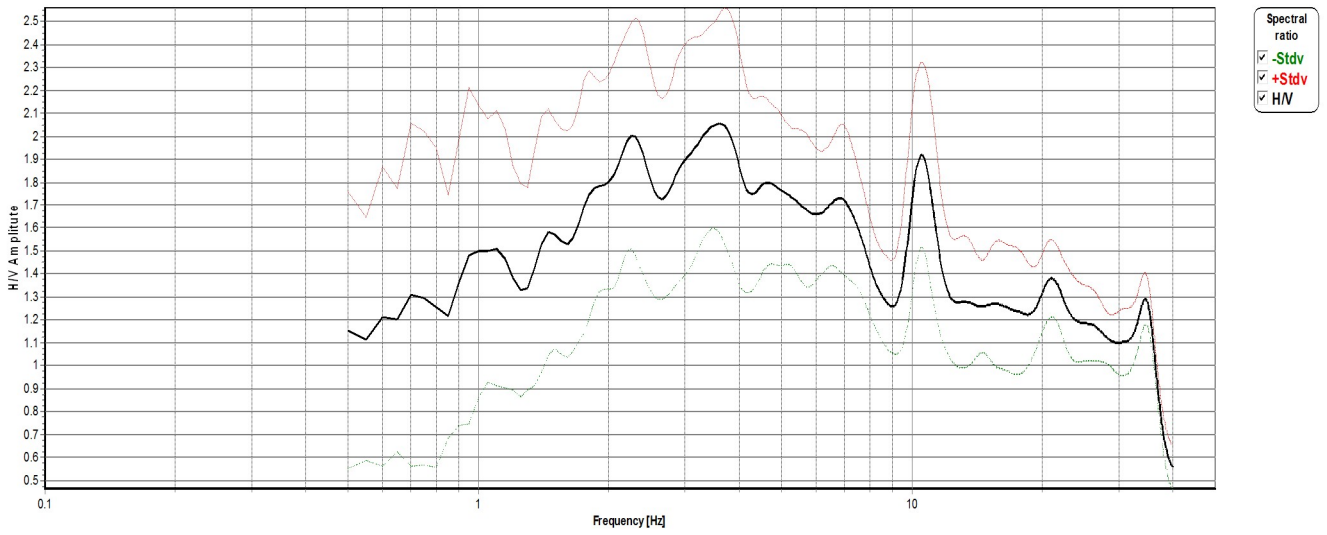
Measure point: **11 Leolini**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**18/02/2021 17:28:09**
Automatic spike removal:	**No**	Stop recordings:	**18/02/2021 17:58:09**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**71**
Lw Windows [s]:	**20**	Recording length [s]:	**1800**
Overlap Windows s]:	**0.0**	Discarded windows:	**19**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**2.303**	Standard deviation [Hz]:	**1.168**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **11 Leolini**

Criteria for a reliable H/V curve		
fø > 10/Lw	**2.30 >= 0.50**	**Yes**
Nc(fø) > 200	**3270.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 69**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**2.00 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**60.67% > 5.00%**	**No**
sf < e(fø)	**1.1681 > 0.1151**	**No**
sA(fø) < ?(fø)	**0.5169 < 1.5800**	**Yes**

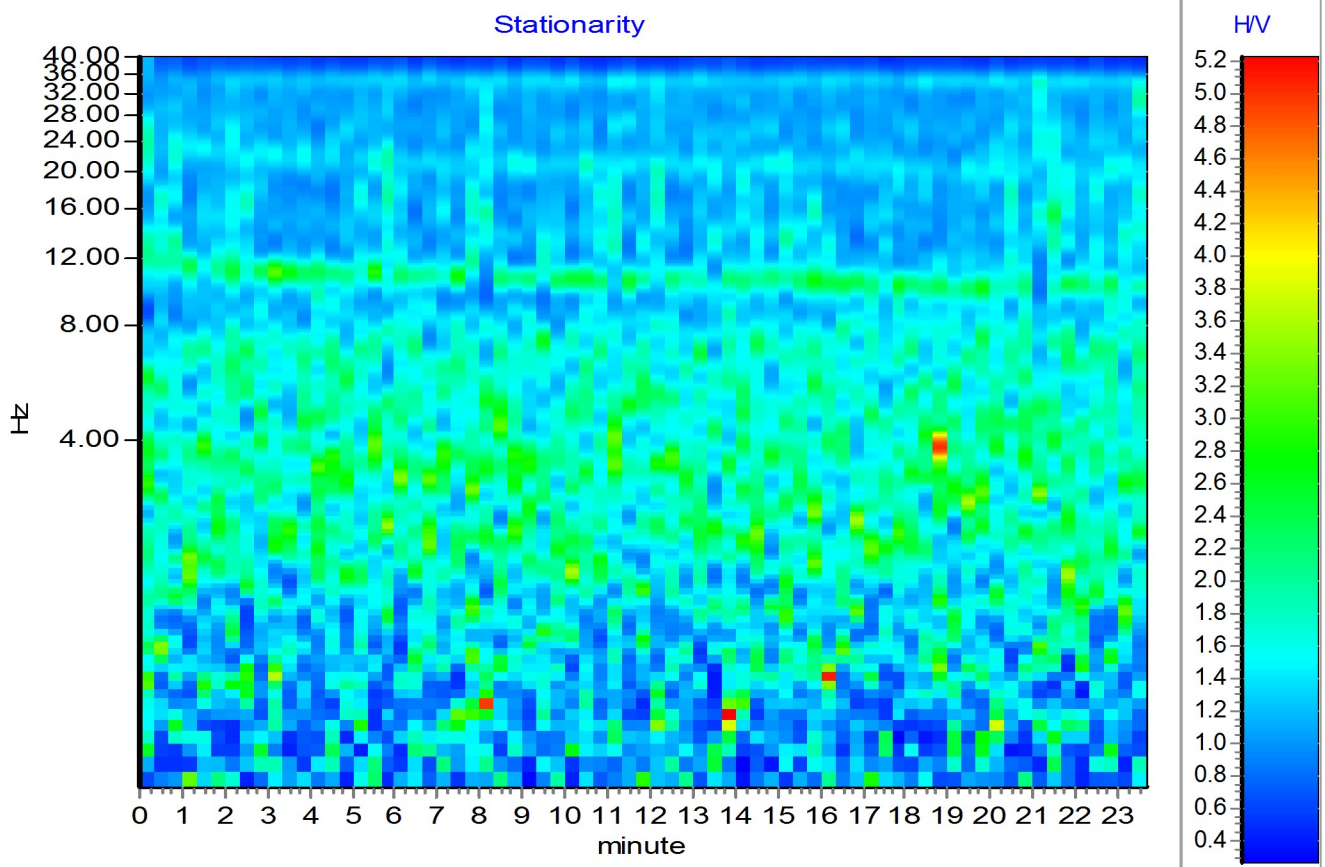
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

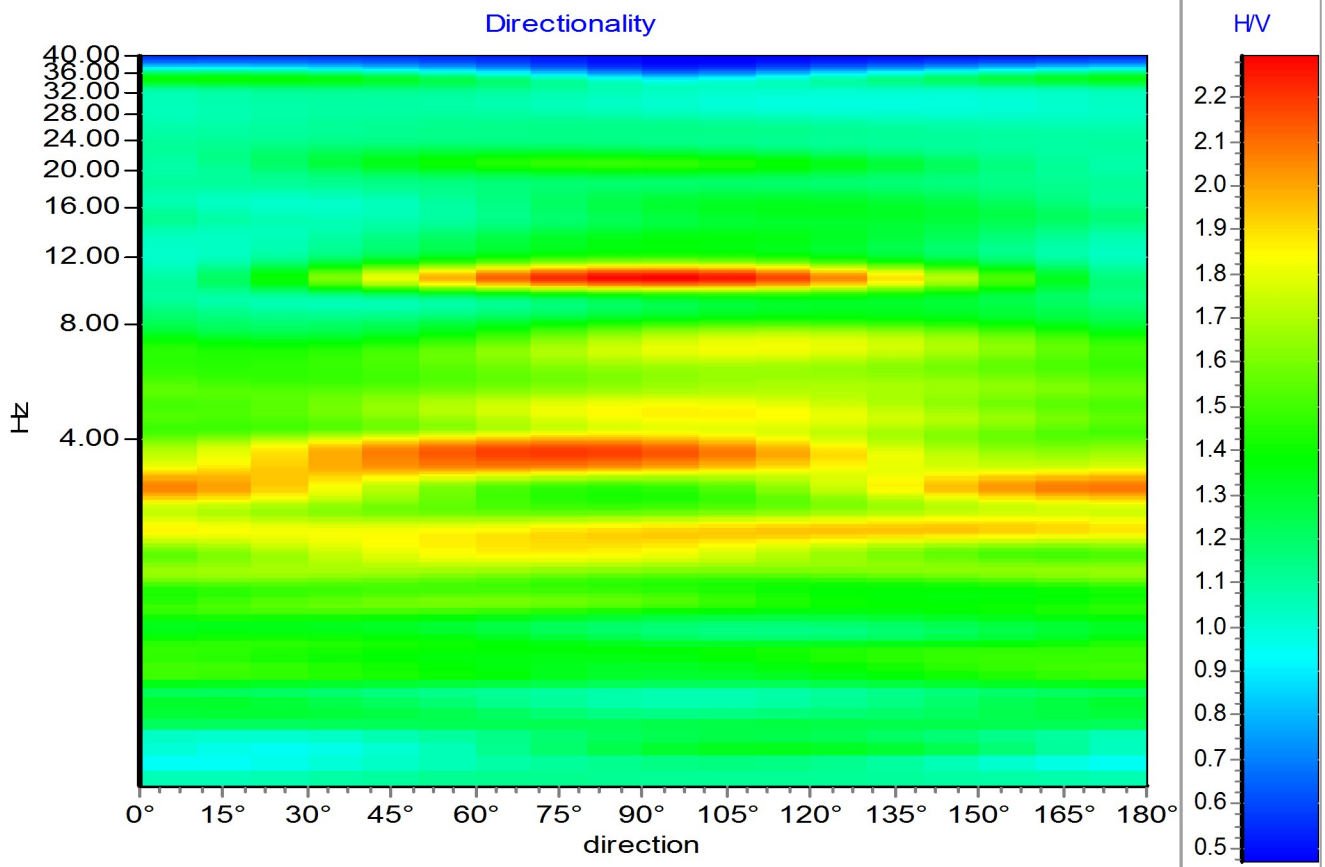
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **11 Leolini**





Misura 12 HVRS

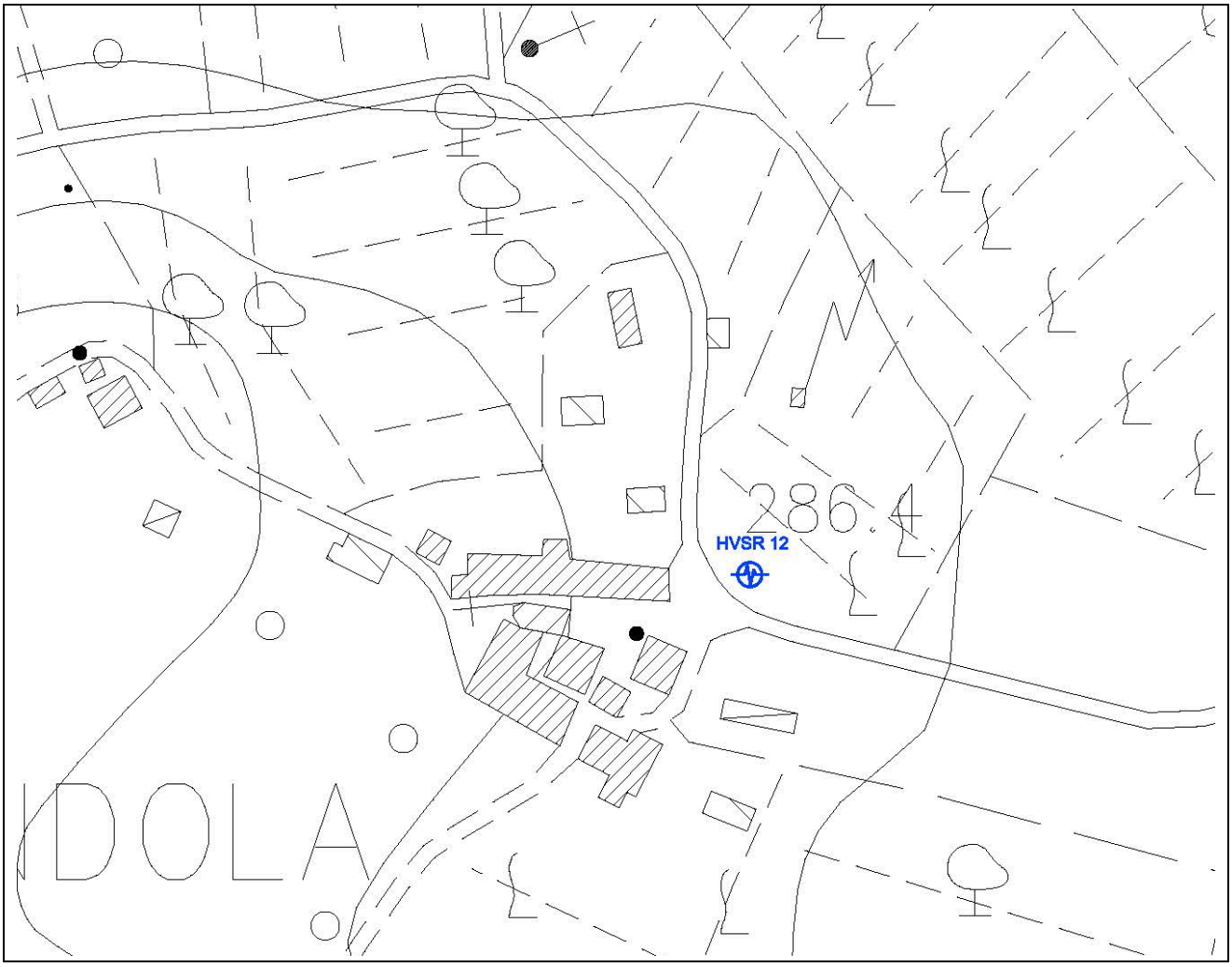


Figura 12.1 – individuazione del sito di studio - scala 1:2.000

Figura 12.2: rilievo sismico

H/V Spectral ratio

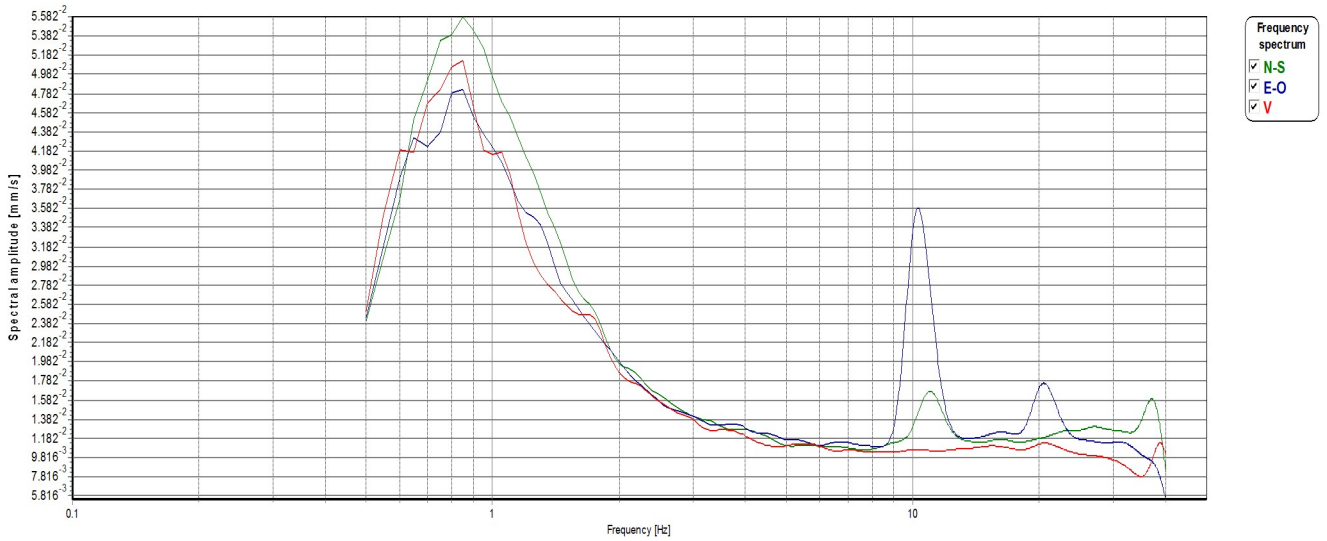
Analysis site: **Montevarchi**

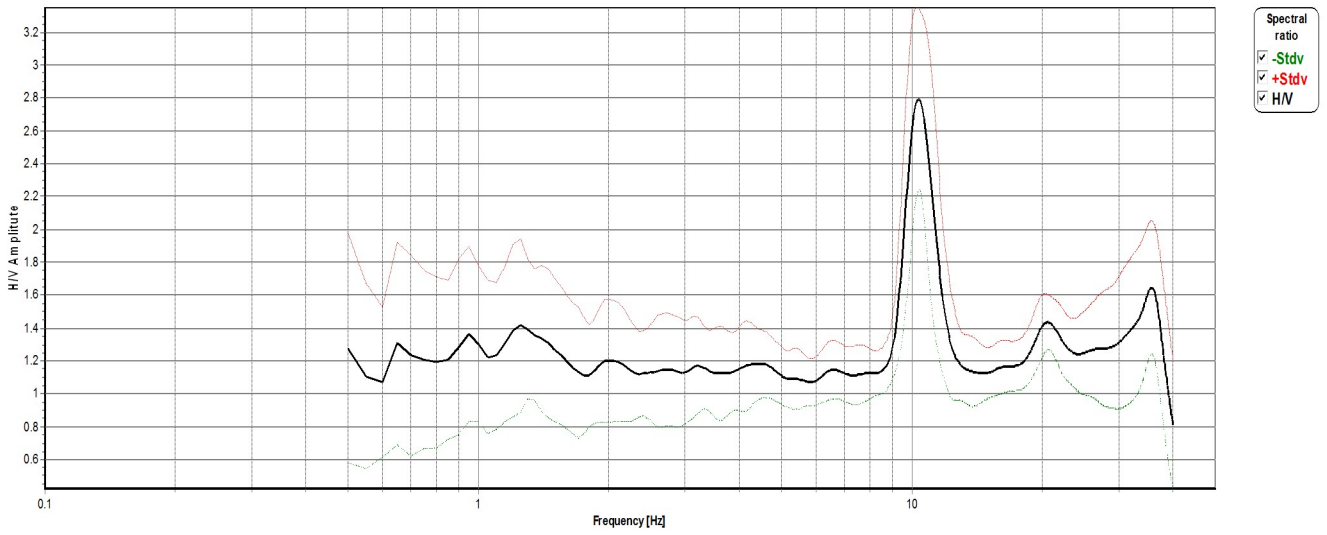
Measure point: **12 Rendola**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**23/02/2021 12:33:26**
Automatic spike removal:	**No**	Stop recordings:	**23/02/2021 13:08:26**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**66**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**39**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**10.411**	Standard deviation [Hz]:	**0.438**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **12 Rendola**

Criteria for a reliable H/V curve		
fø > 10/Lw	**10.41 >= 0.50**	**Yes**
Nc(fø) > 200	**13743.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 312**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**2.650**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**12.100**	**Yes**
Aø > 2	**2.79 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**1.55% < 5.00%**	**Yes**
sf < e(fø)	**0.4379 < 0.5206**	**Yes**
sA(fø) < ?(fø)	**0.5462 < 1.5800**	**Yes**

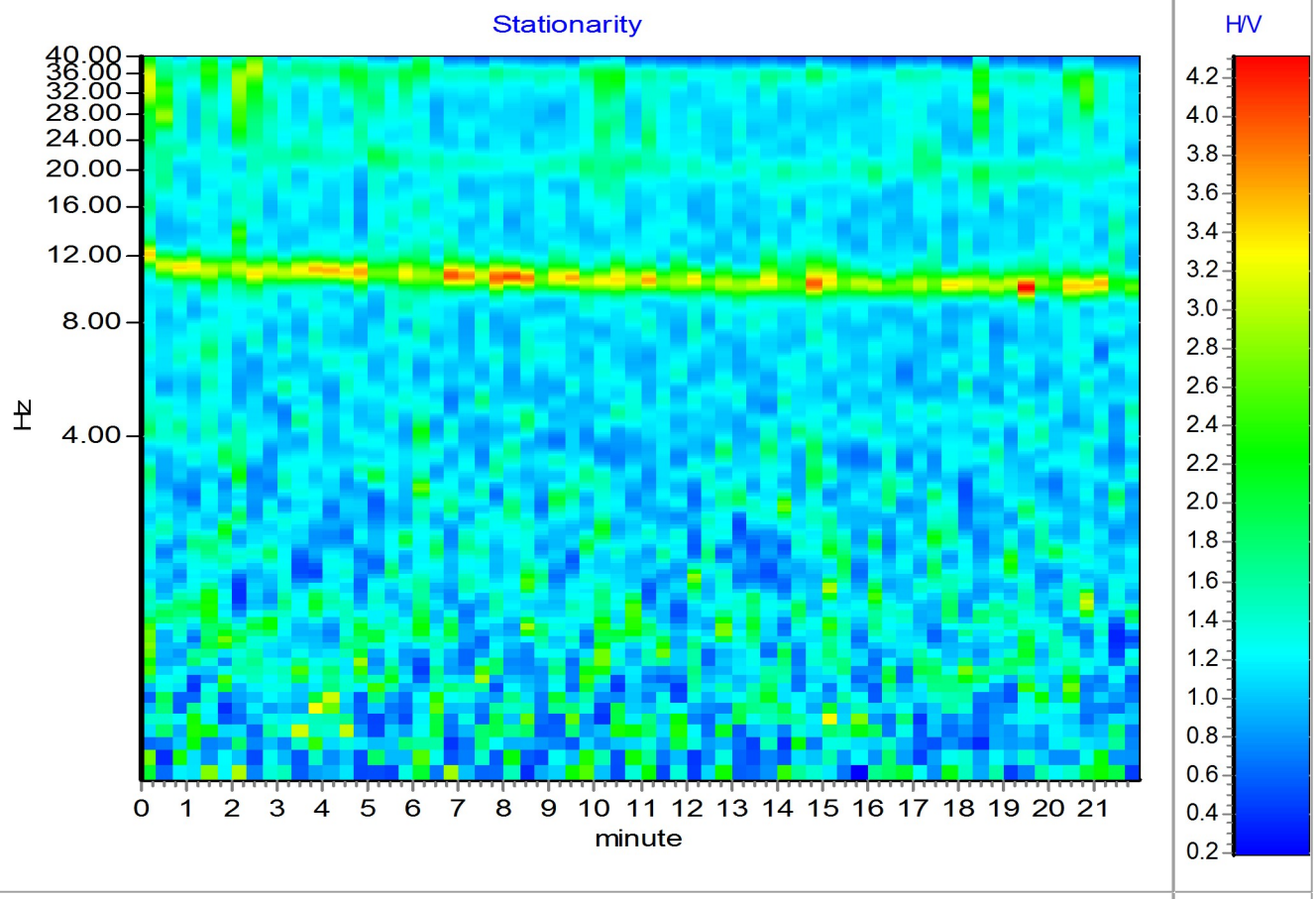
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

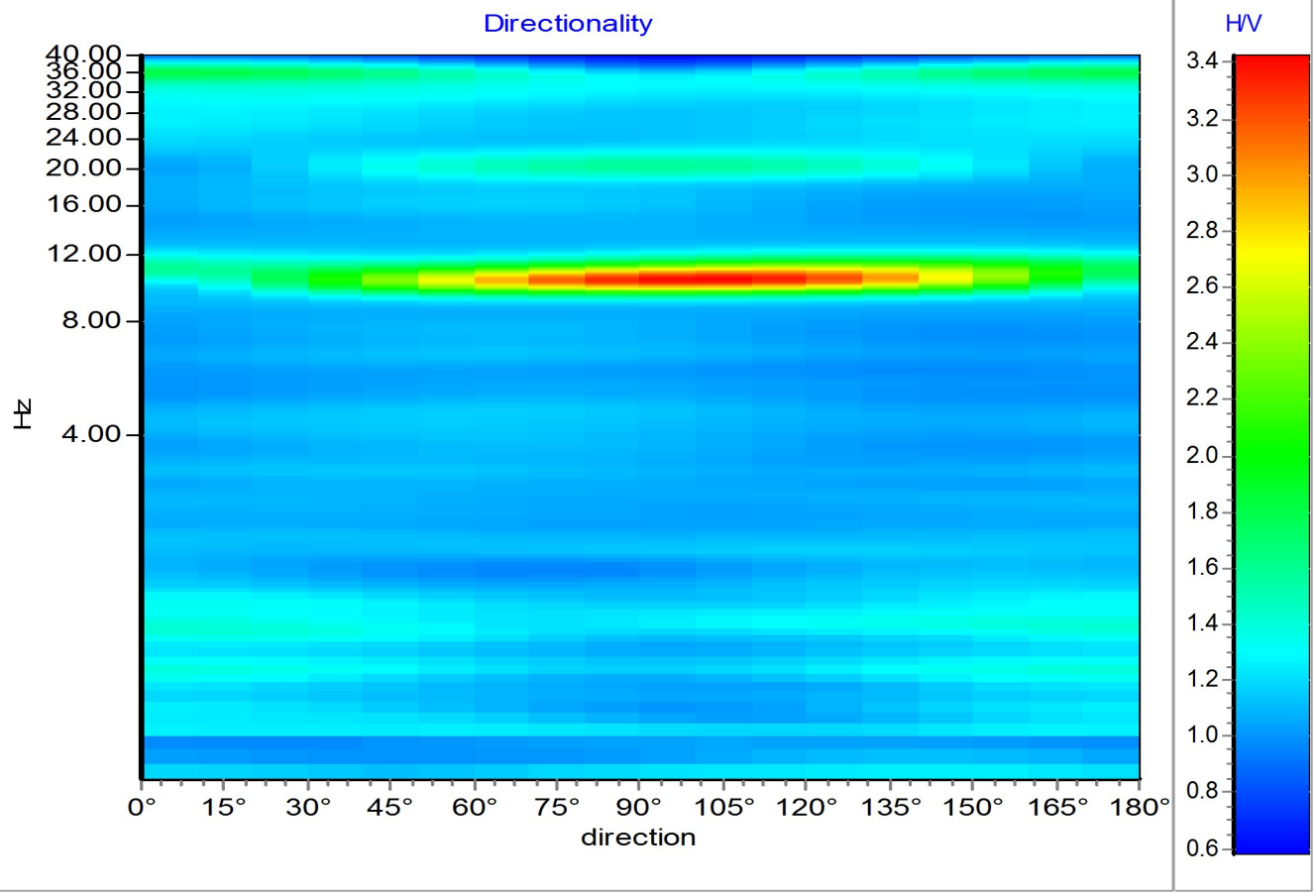
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **12 Rendola**





Misura 13 HVRS

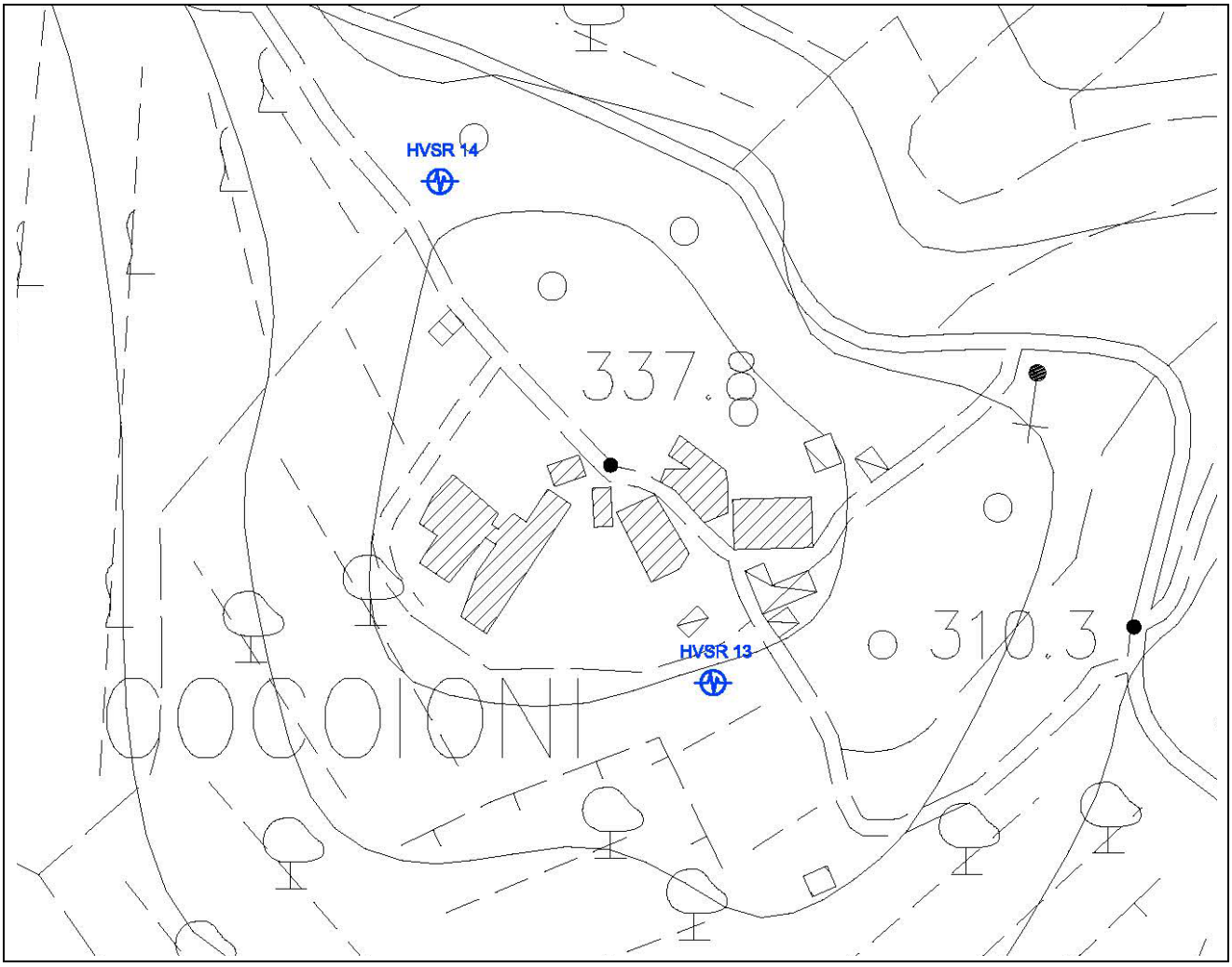


Figura 13.1 – individuazione del sito di studio - scala 1:2.000

Figura 13.2: rilievo sismico

H/V Spectral ratio

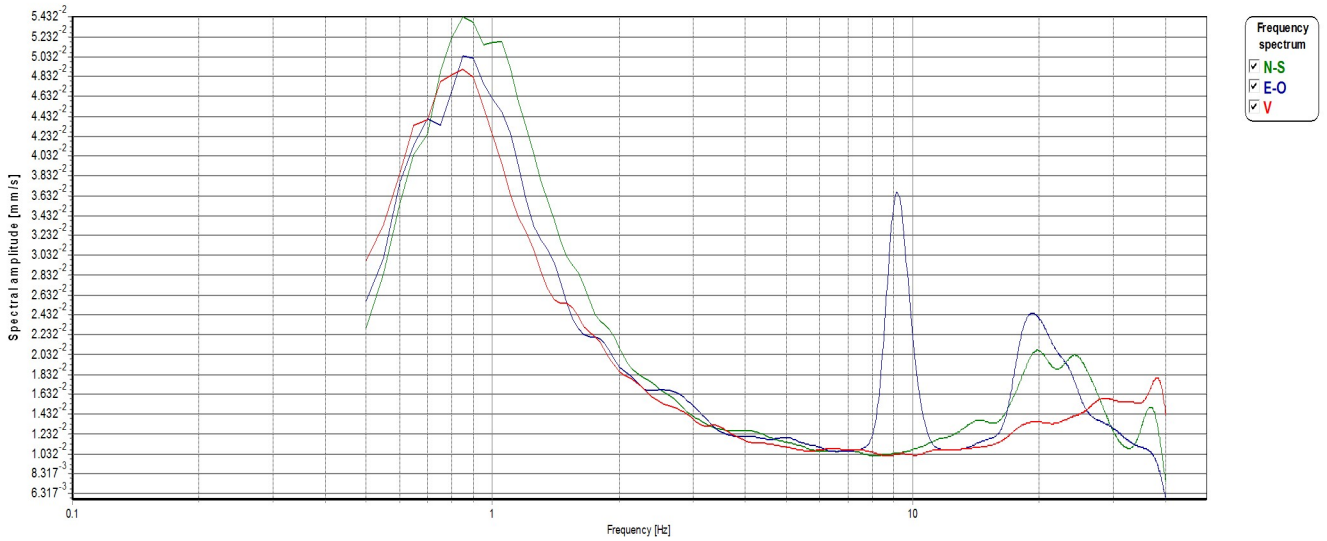
Analysis site: **Montevarchi**

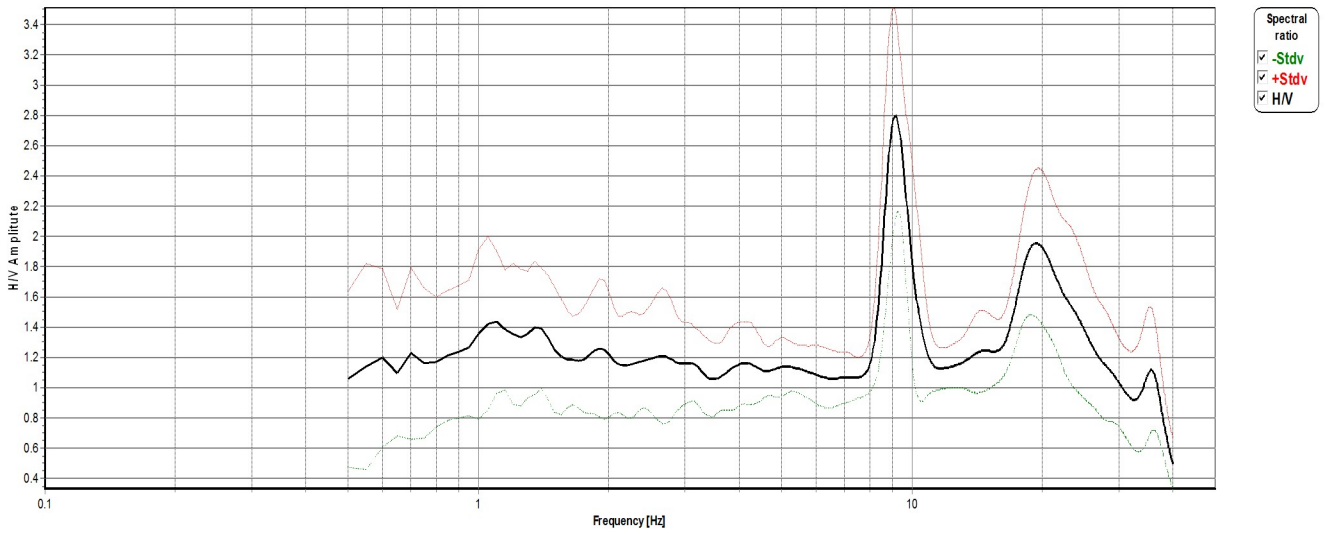
Measure point: **13 Cocoioni**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**23/02/2021 13:27:03**
Automatic spike removal:	**No**	Stop recordings:	**23/02/2021 13:57:03**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**44**
Lw Windows [s]:	**20**	Recording length [s]:	**1800**
Overlap Windows s]:	**0.0**	Discarded windows:	**46**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**9.268**	Standard deviation [Hz]:	**0.378**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **13 Cocoioni**

Criteria for a reliable H/V curve		
fø > 10/Lw	**9.27 >= 0.50**	**Yes**
Nc(fø) > 200	**8156.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 278**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**2.350**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**10.550**	**Yes**
Aø > 2	**2.77 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**2.35% < 5.00%**	**Yes**
sf < e(fø)	**0.3775 < 0.4634**	**Yes**
sA(fø) < ?(fø)	**0.6110 < 1.5800**	**Yes**

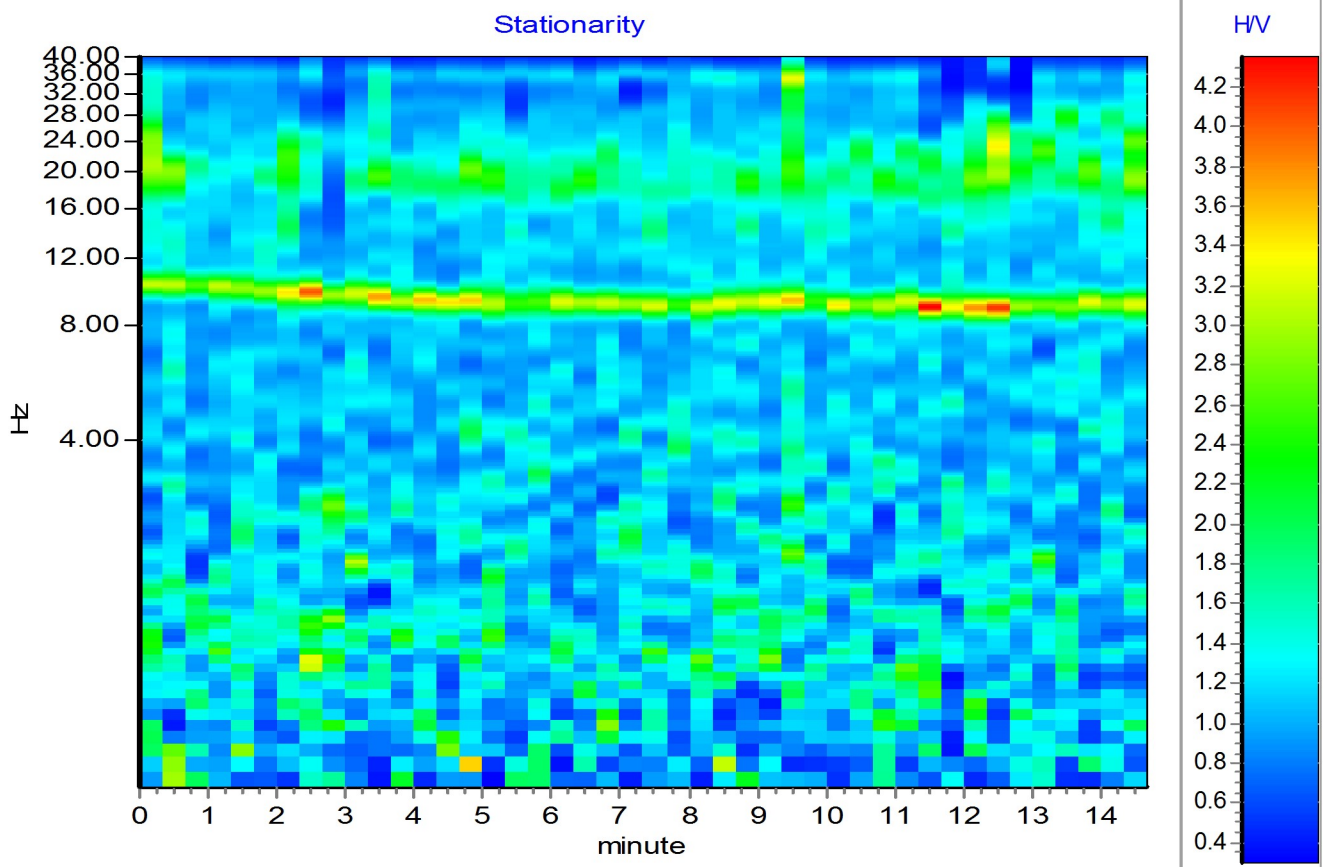
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

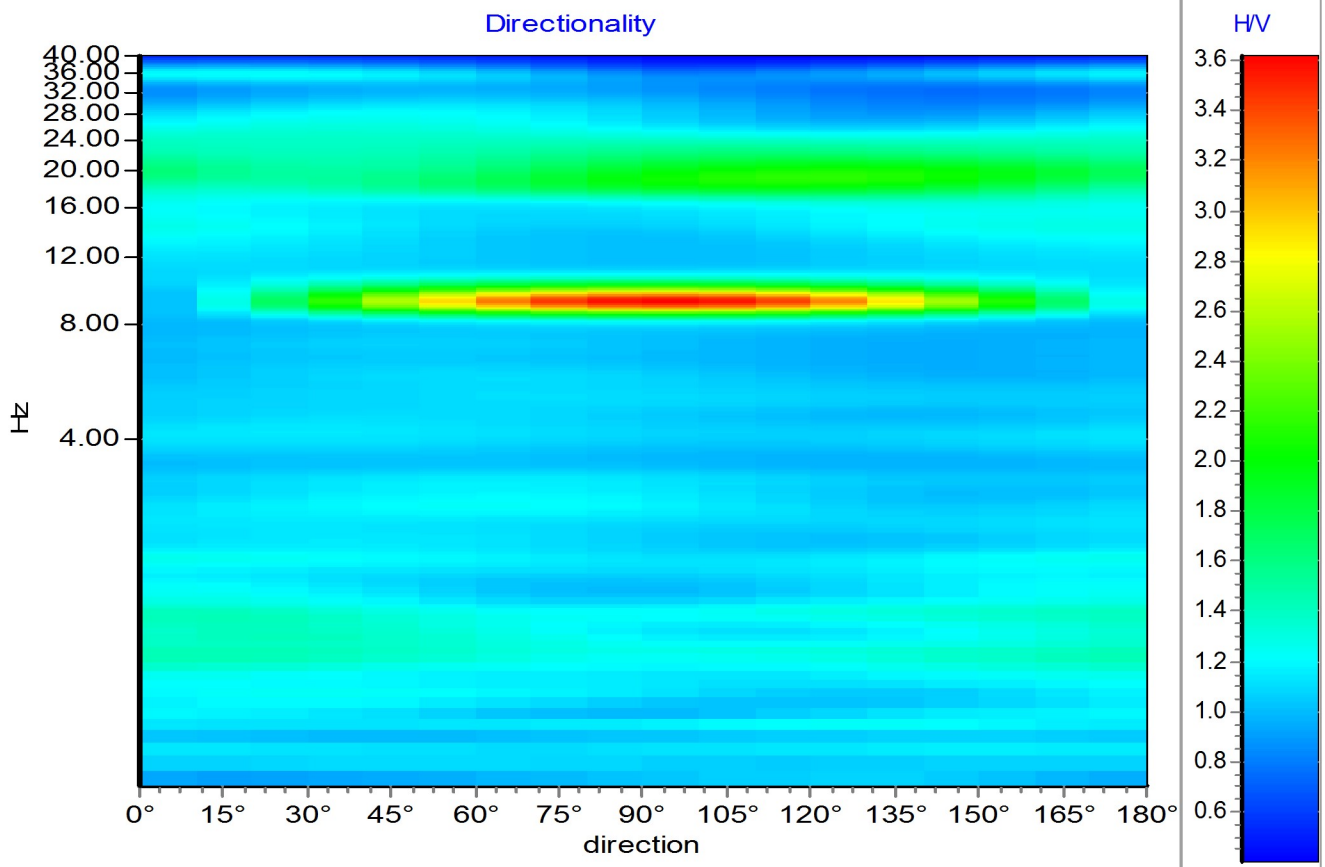
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **13 Cocoioni**





Misura 14 HVRS

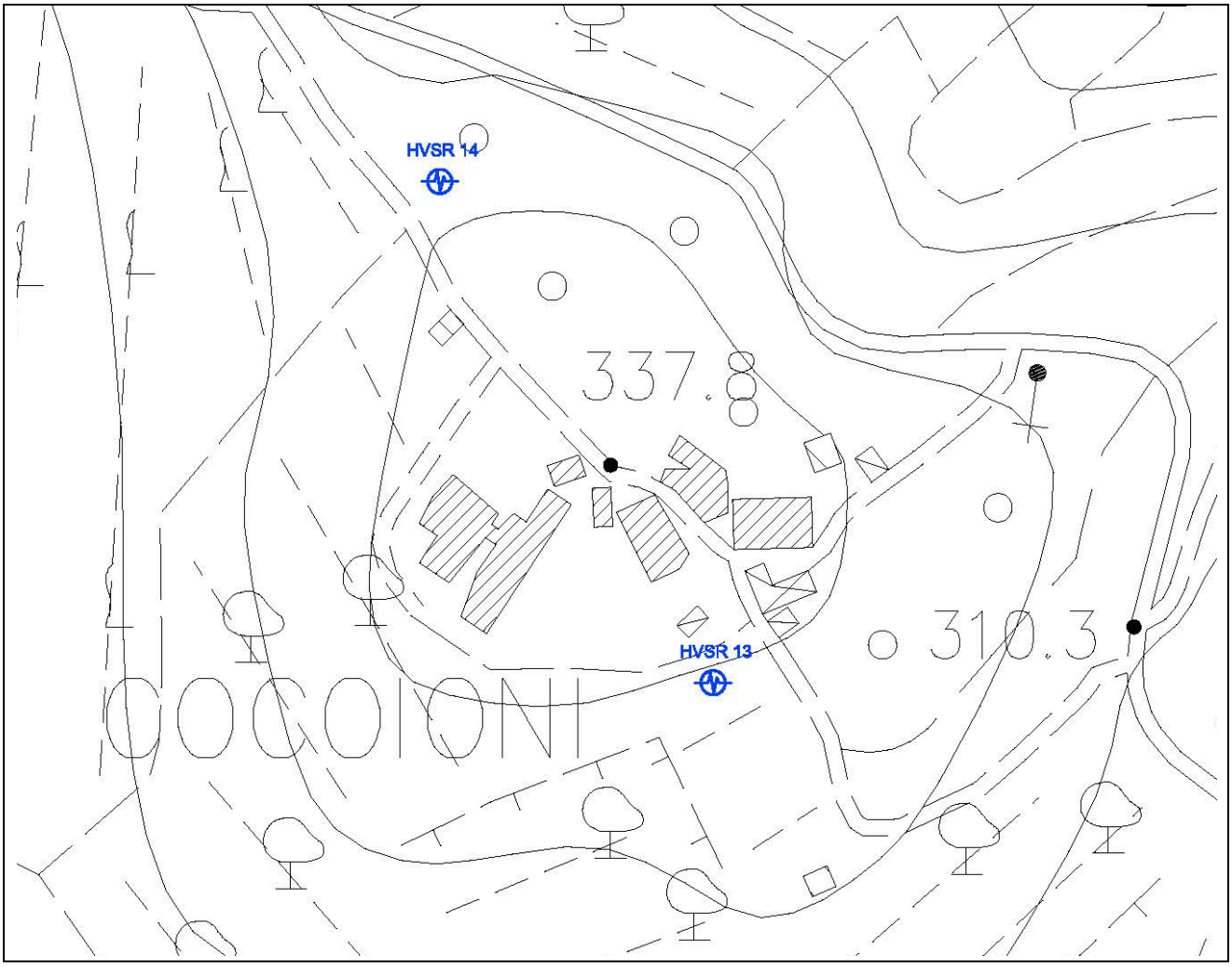


Figura 14.1 – individuazione del sito di studio - scala 1:2.000

Figura 14.2: rilievo sismico

H/V Spectral ratio

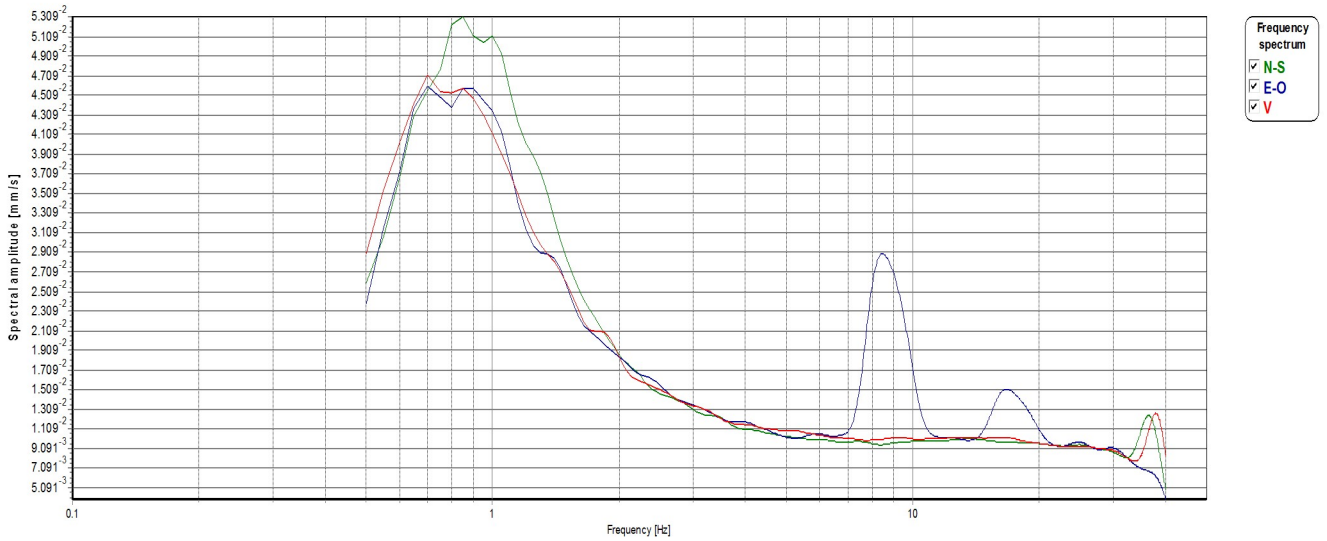
Analysis site: **Montevarchi**

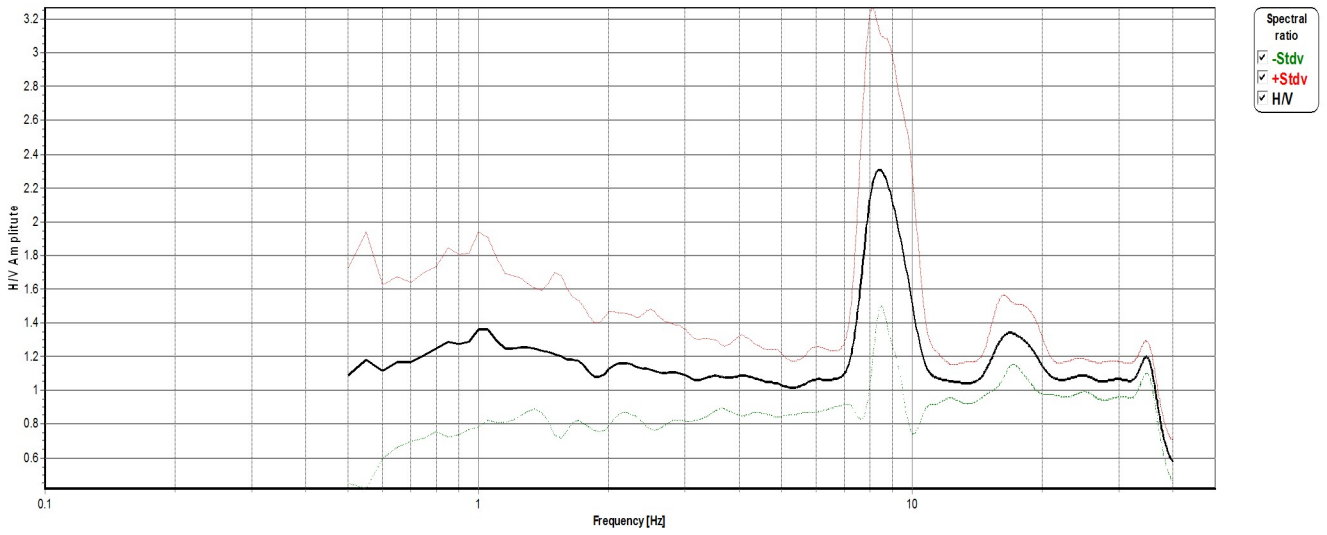
Measure point: **14 Cocoioni**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**23/02/2021 14:13:55**
Automatic spike removal:	**No**	Stop recordings:	**23/02/2021 14:48:55**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**82**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**23**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**8.716**	Standard deviation [Hz]:	**0.640**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **14 Cocoioni**

Criteria for a reliable H/V curve		
fø > 10/Lw	**8.72 >= 0.50**	**Yes**
Nc(fø) > 200	**14294.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 261**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**2.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**10.850**	**Yes**
Aø > 2	**2.25 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**7.07% > 5.00%**	**No**
sf < e(fø)	**0.6399 > 0.4358**	**No**
sA(fø) < ?(fø)	**0.8340 < 1.5800**	**Yes**

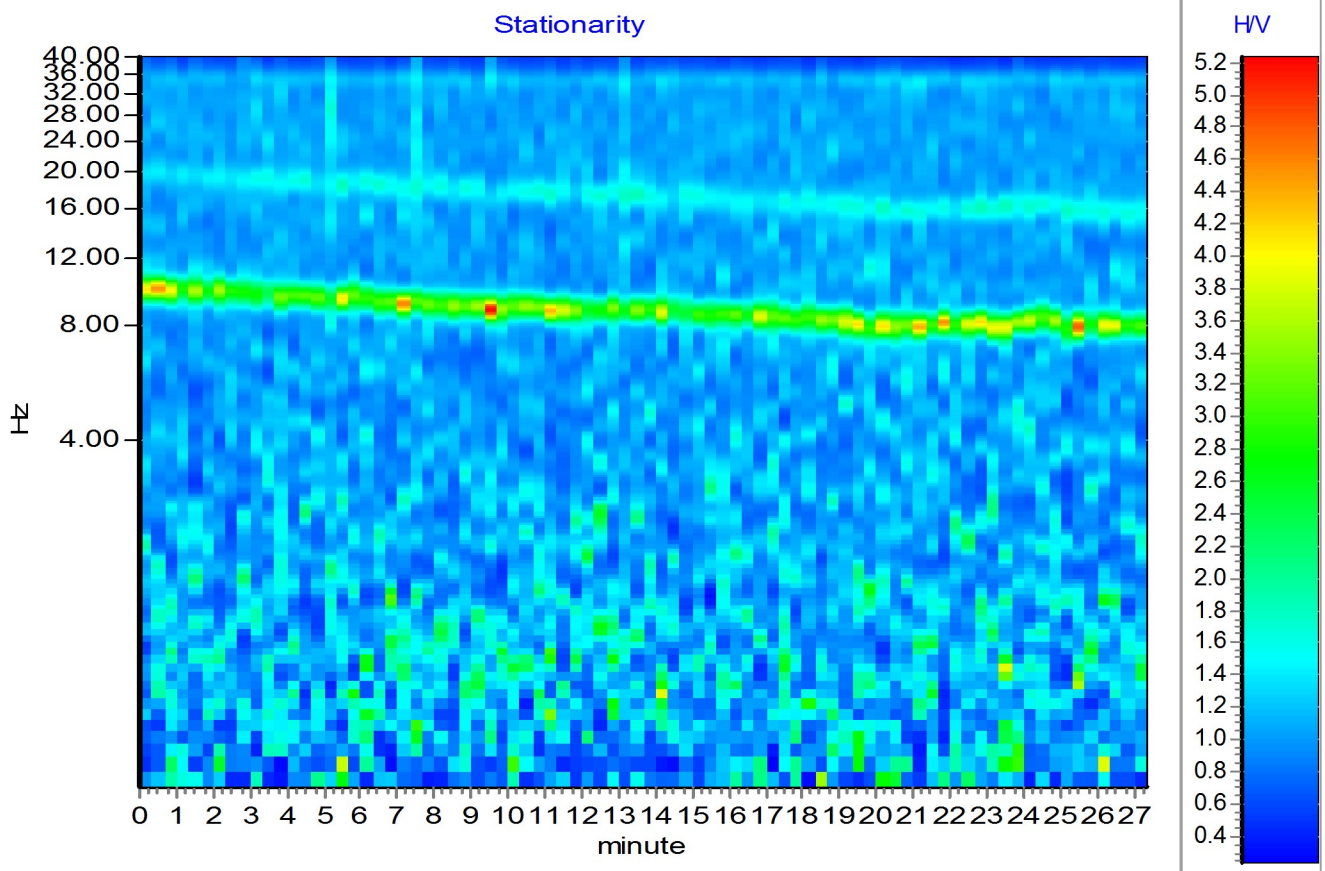
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

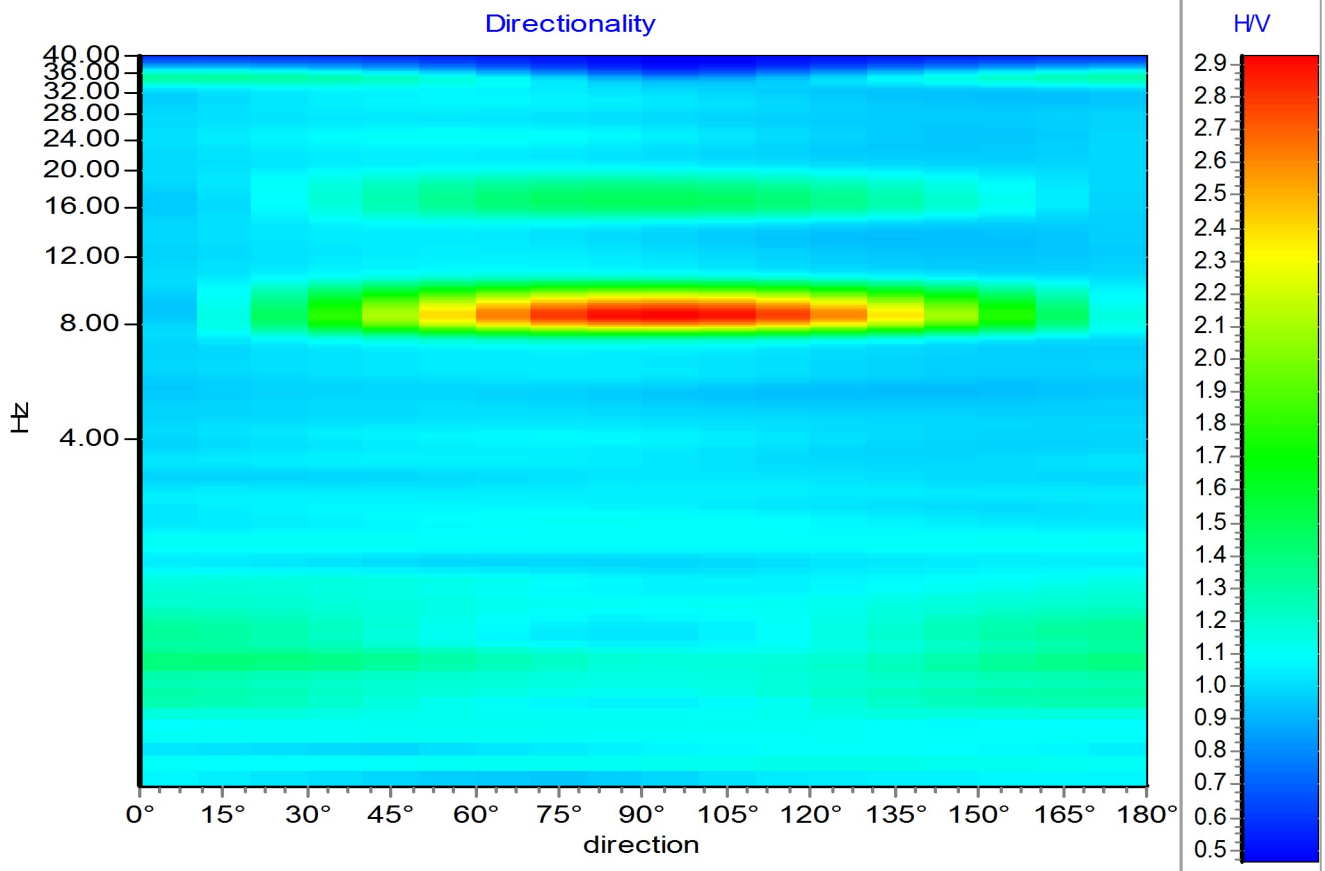
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **14 Cocoioni**





Misura 15 HVRS

Figura 15.1 – individuazione del sito di studio - scala 1:2.000

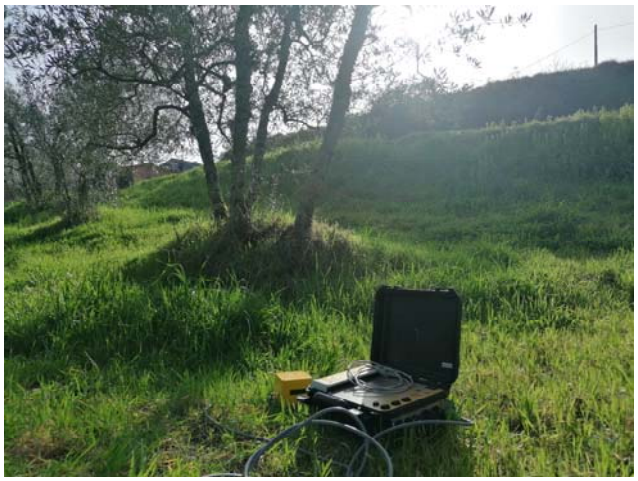


Figura 15.2: rilievo sismico

H/V Spectral ratio

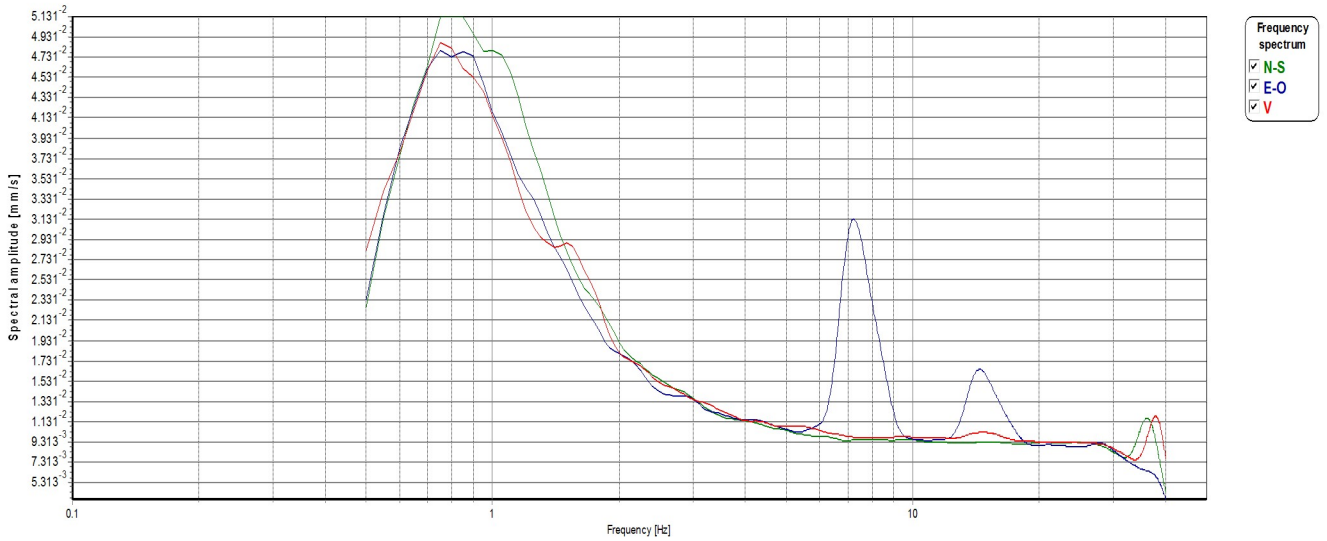
Analysis site: **Montevarchi**

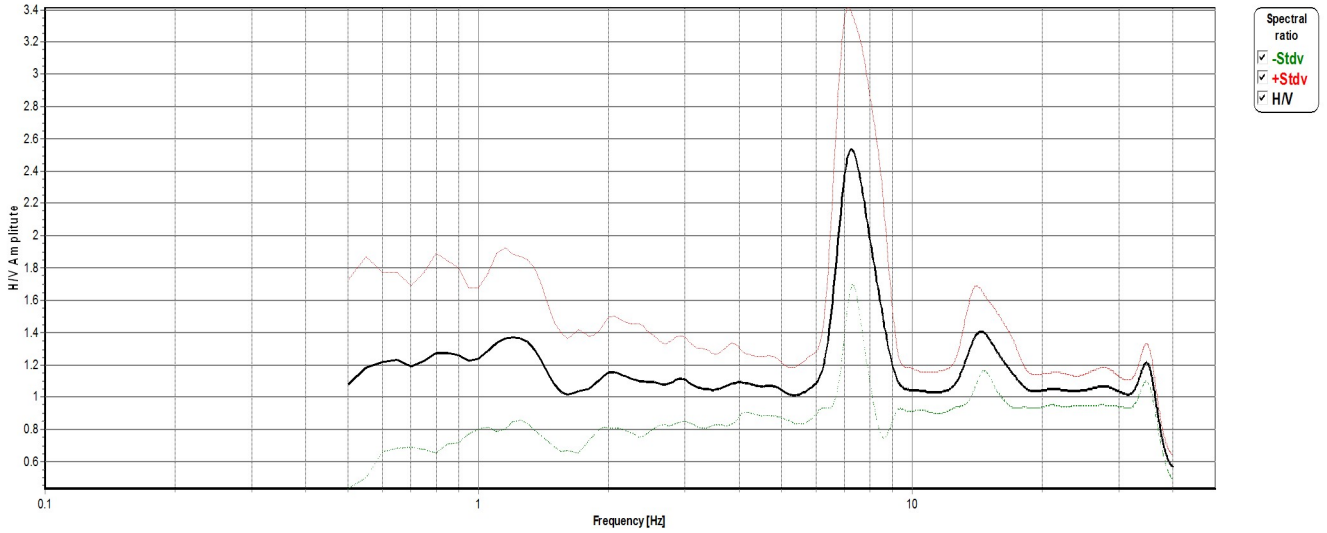
Measure point: **15 Ventena**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**23/02/2021 15:08:29**
Automatic spike removal:	**No**	Stop recordings:	**23/02/2021 15:43:29**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**85**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**20**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**7.476**	Standard deviation [Hz]:	**0.513**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **15 Ventena**

Criteria for a reliable H/V curve		
fø > 10/Lw	**7.48 >= 0.50**	**Yes**
Nc(fø) > 200	**12709.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 225**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**1.900**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**9.000**	**Yes**
Aø > 2	**2.43 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**4.36% < 5.00%**	**Yes**
sf < e(fø)	**0.5130 > 0.3738**	**No**
sA(fø) < ?(fø)	**0.8395 < 1.5800**	**Yes**

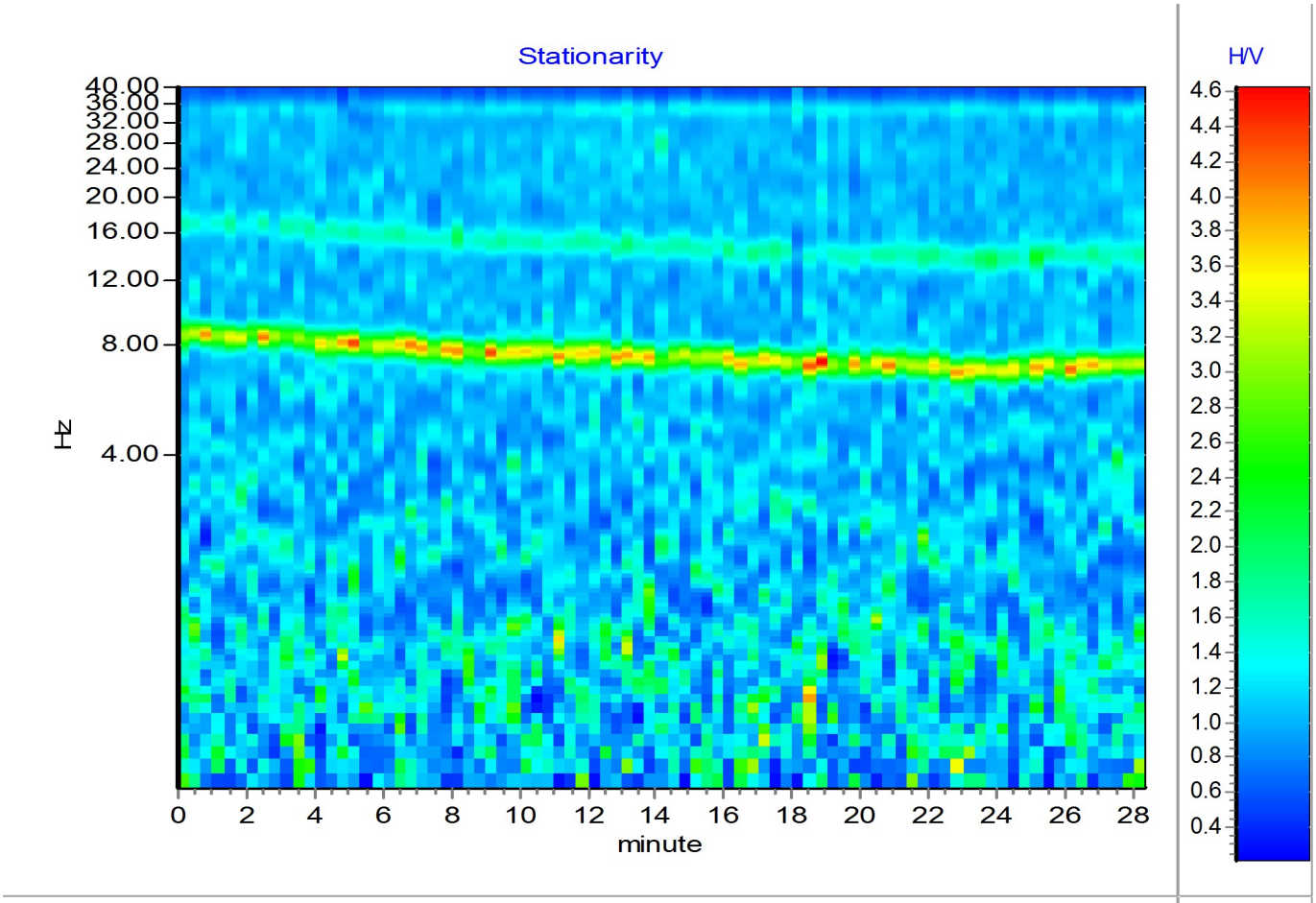
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

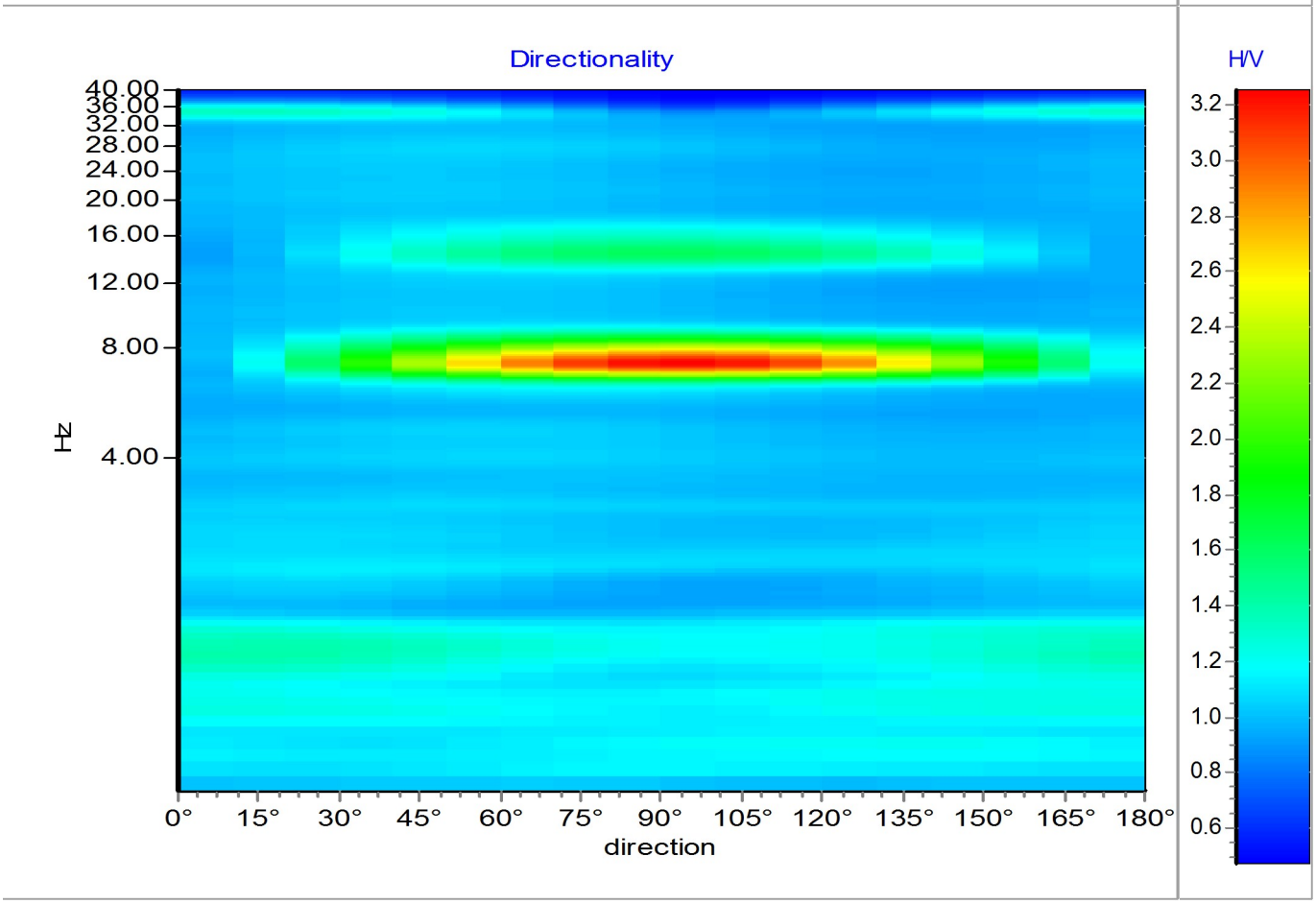
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **15 Ventena**





Misura 16 HVRS

Figura 16.1 – individuazione del sito di studio - scala 1:2.000

Figura 16.2: rilievo sismico

H/V Spectral ratio

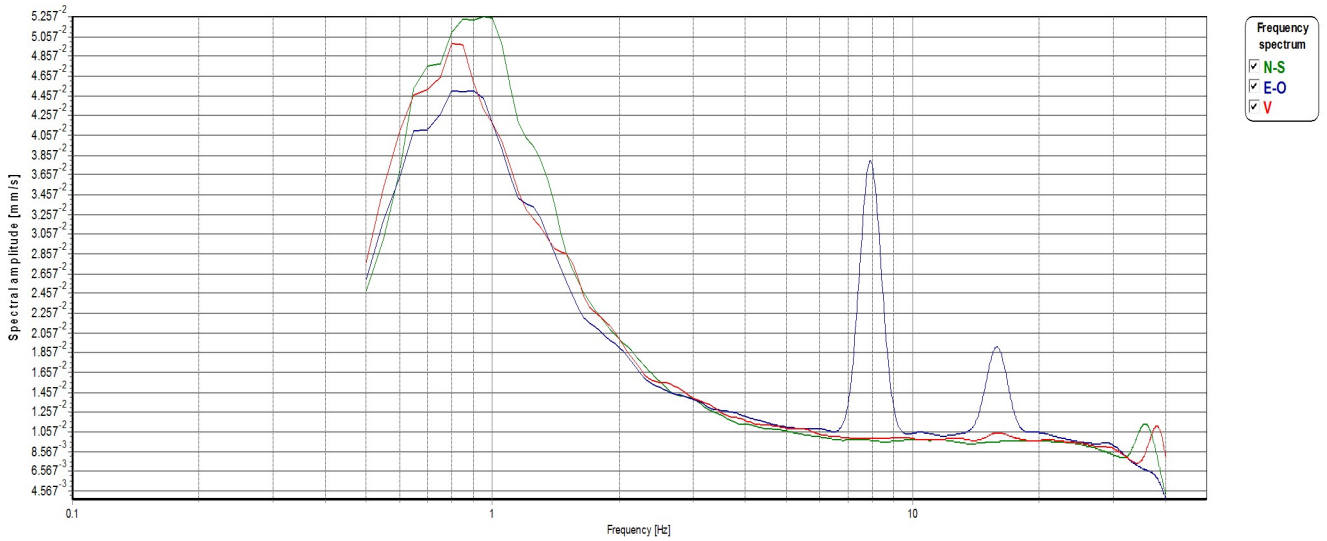
Analysis site: **Montevarchi**

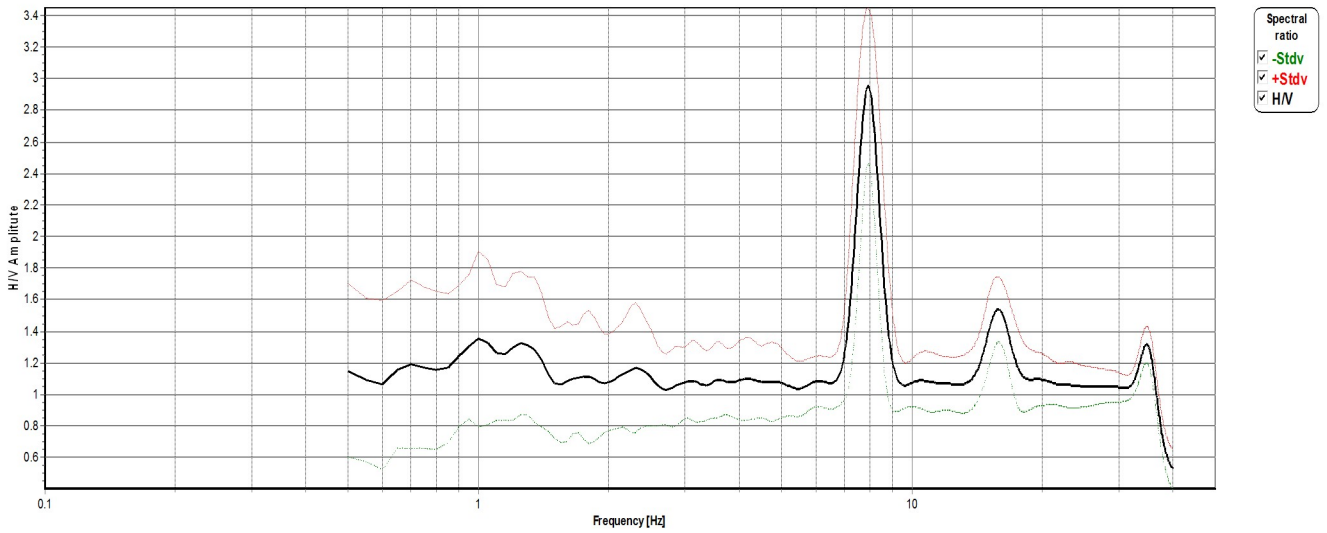
Measure point: **16 Ventena**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**23/02/2021 15:59:54**
Automatic spike removal:	**No**	Stop recordings:	**23/02/2021 16:34:54**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**75**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**30**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**7.930**	Standard deviation [Hz]:	**0.222**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **16 Ventena**

Criteria for a reliable H/V curve		
fø > 10/Lw	**7.93 >= 0.50**	**Yes**
Nc(fø) > 200	**11895.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 238**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**2.000**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**8.800**	**Yes**
Aø > 2	**2.95 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**0.38% < 5.00%**	**Yes**
sf < e(fø)	**0.2215 < 0.3965**	**Yes**
sA(fø) < ?(fø)	**0.4925 < 1.5800**	**Yes**

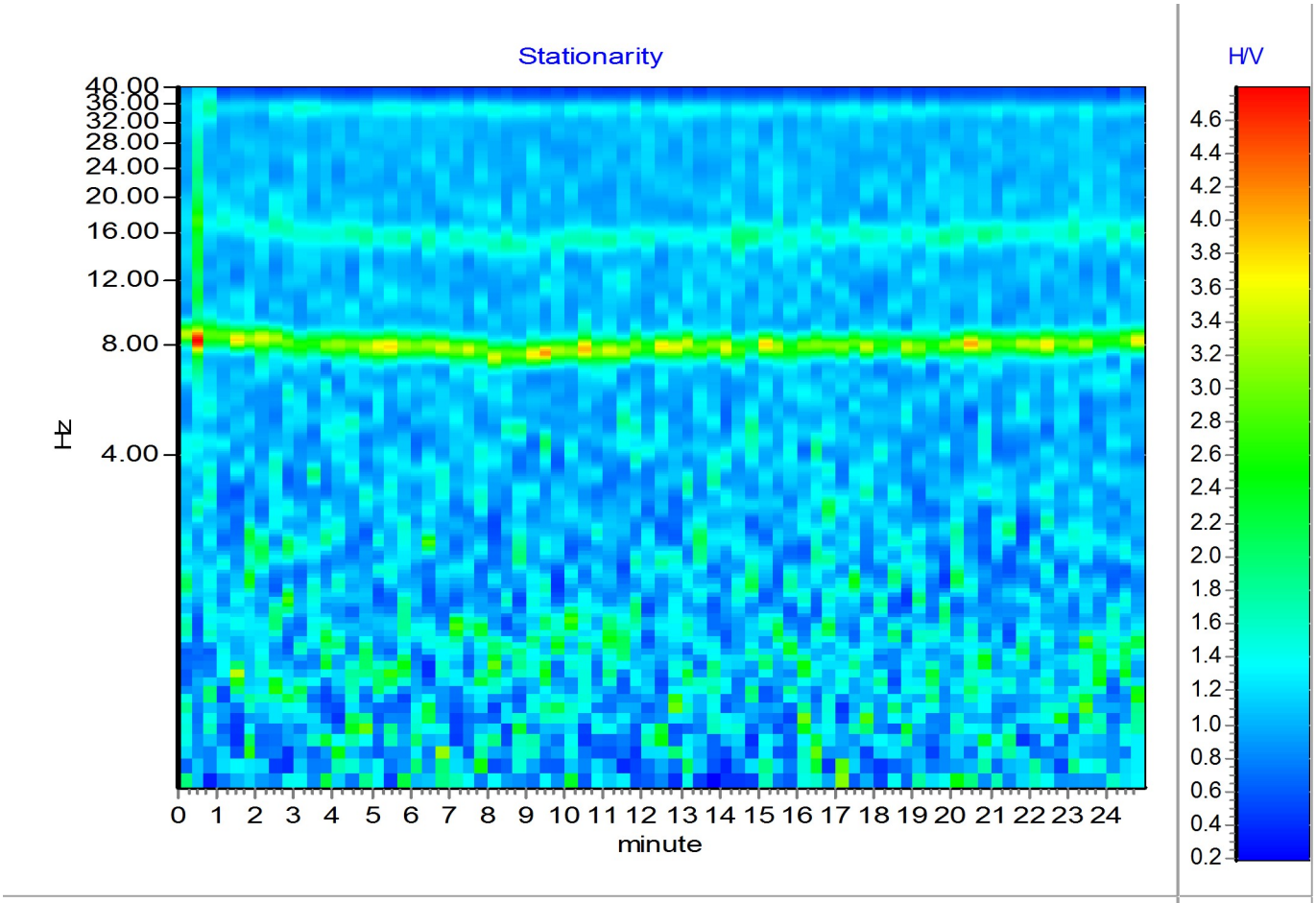
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

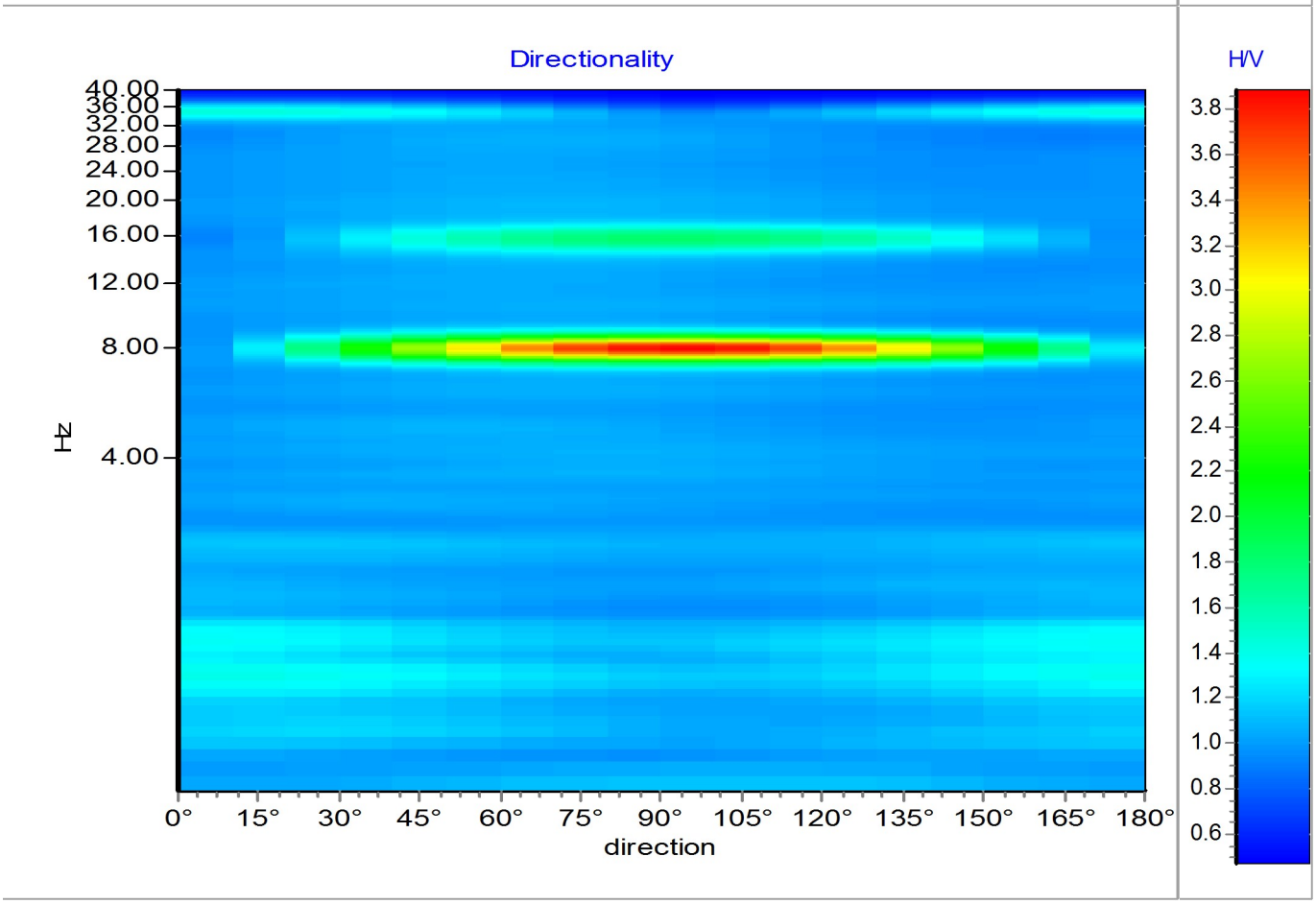
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **16 Ventena**





Misura 17 HVRS

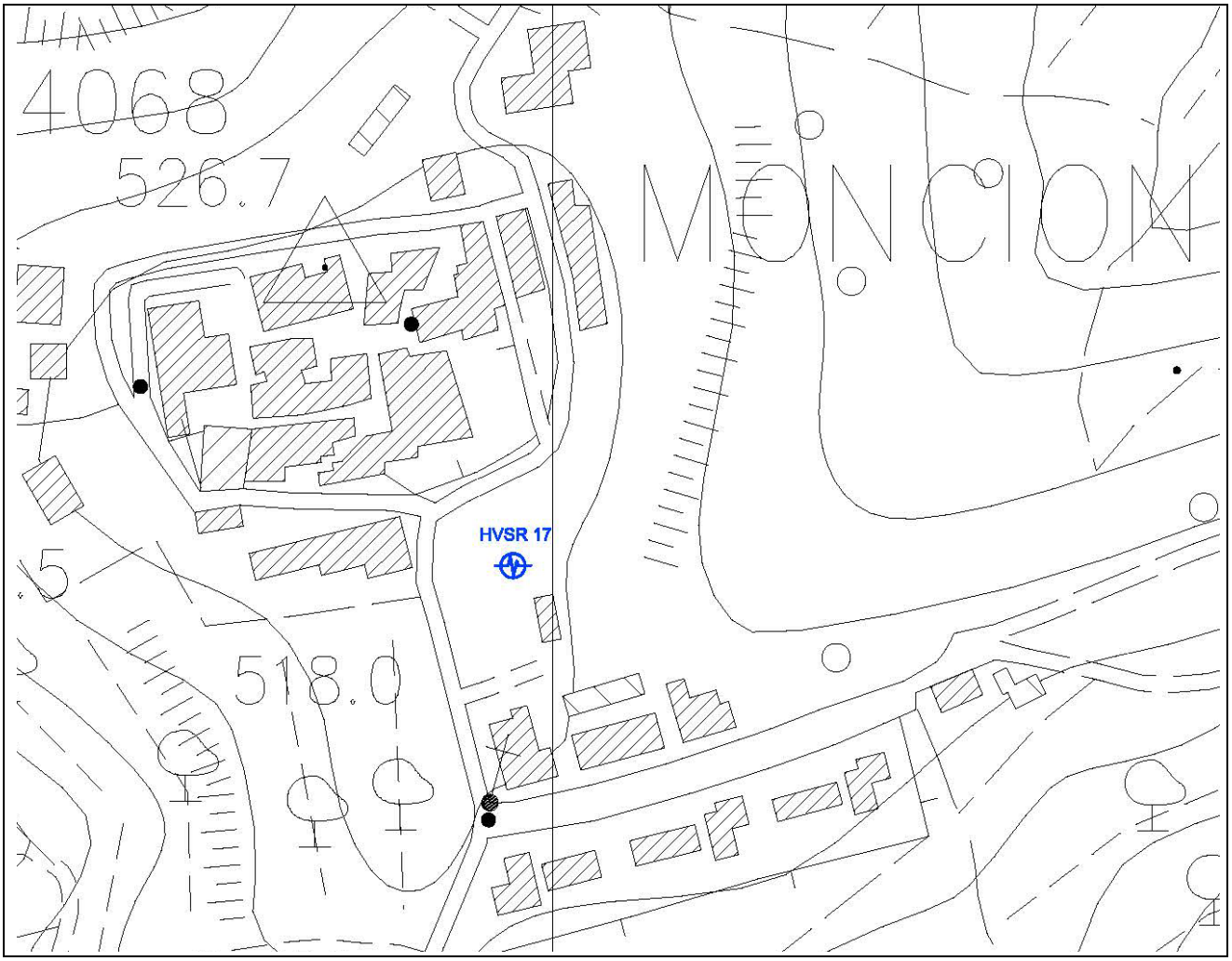


Figura 17.1 – individuazione del sito di studio - scala 1:2.000

Figura 17.2: rilievo sismico

H/V Spectral ratio

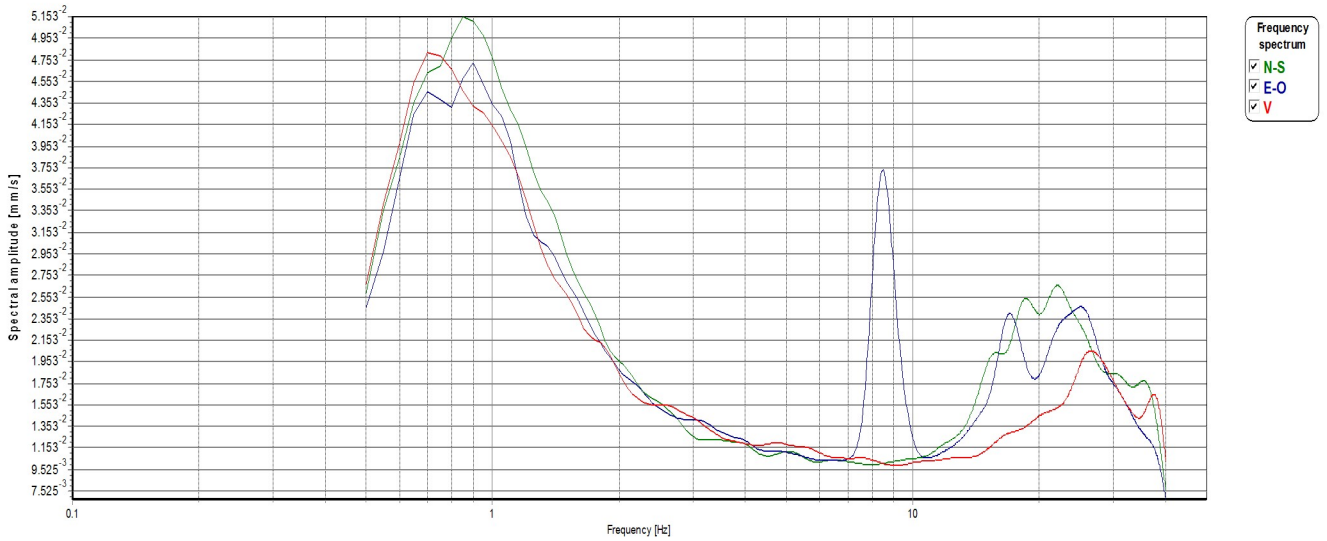
Analysis site: **Montevarchi**

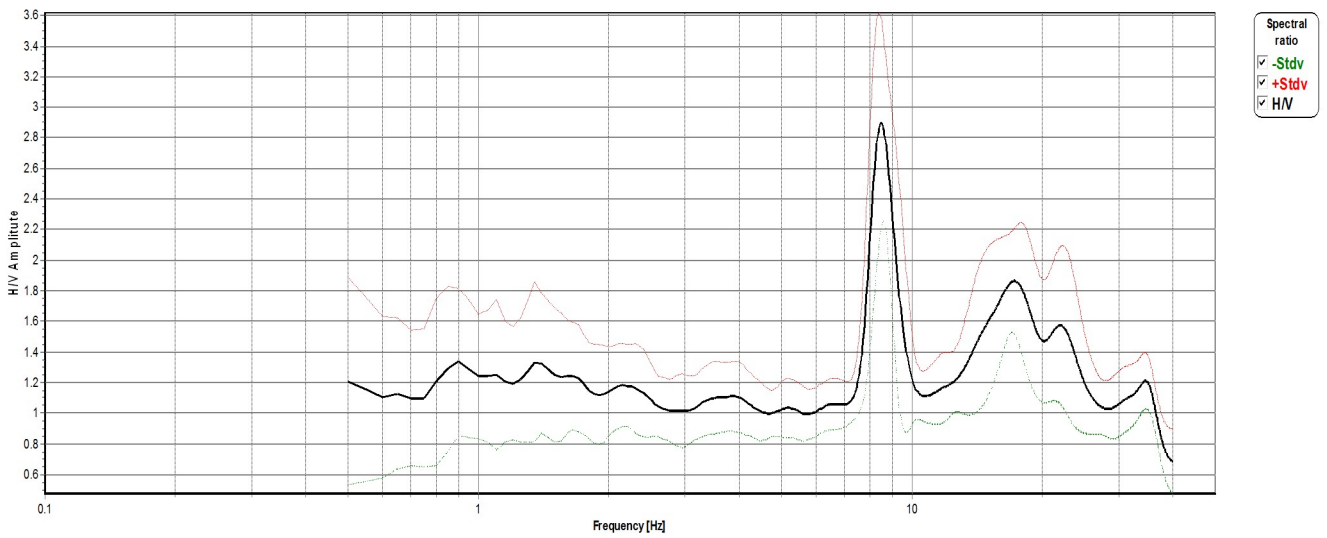
Measure point: **17 Moncioni**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**23/02/2021 16:54:58**
Automatic spike removal:	**No**	Stop recordings:	**23/02/2021 17:29:58**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**72**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**33**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**8.578**	Standard deviation [Hz]:	**0.335**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **17 Moncioni**

Criteria for a reliable H/V curve		
fø > 10/Lw	**8.58 >= 0.50**	**Yes**
Nc(fø) > 200	**12353.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 258**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**2.150**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**9.700**	**Yes**
Aø > 2	**2.86 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**2.08% < 5.00%**	**Yes**
sf < e(fø)	**0.3348 < 0.4289**	**Yes**
sA(fø) < ?(fø)	**0.6033 < 1.5800**	**Yes**

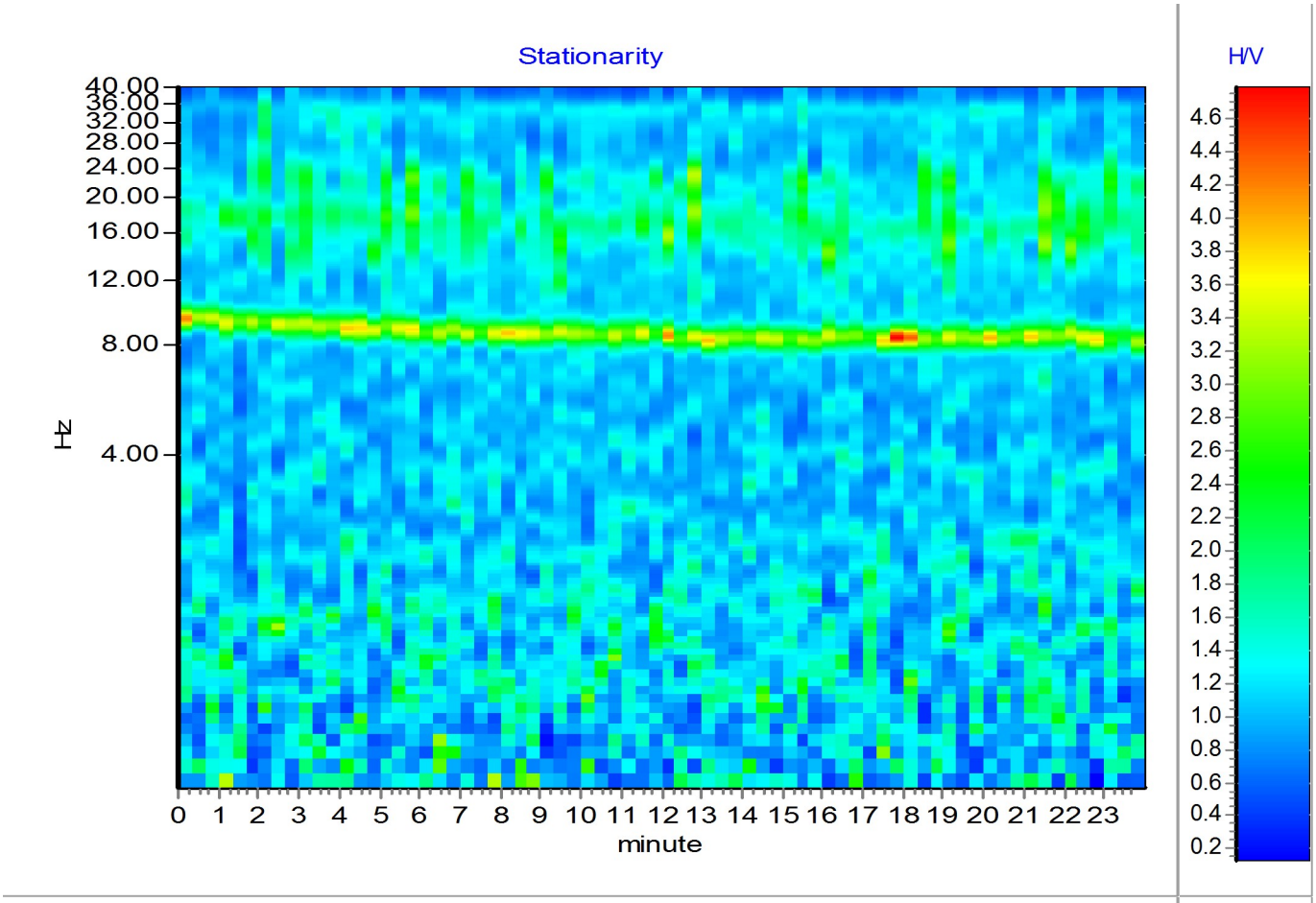
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

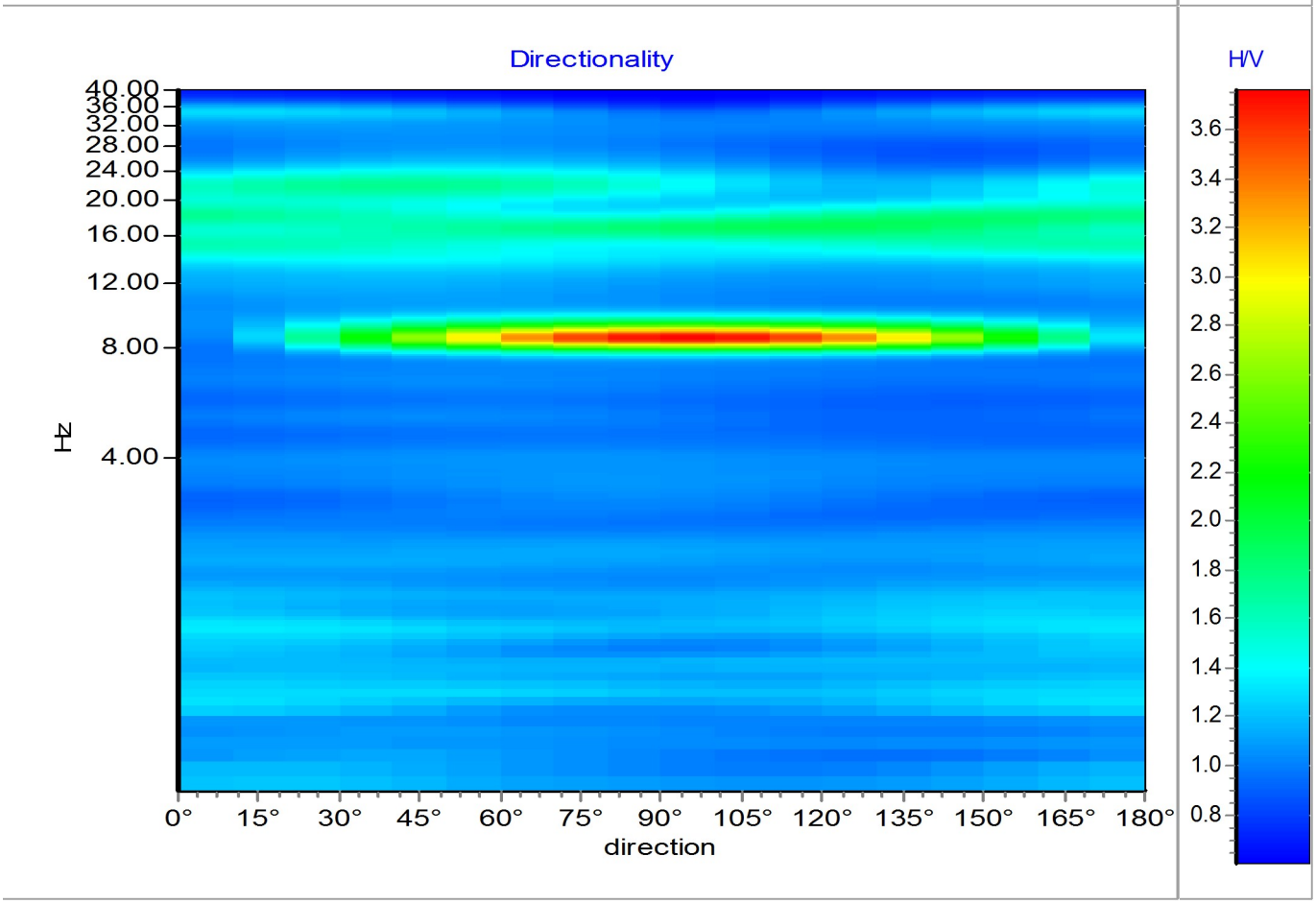
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **17 Moncioni**





Misura 18 HVRS

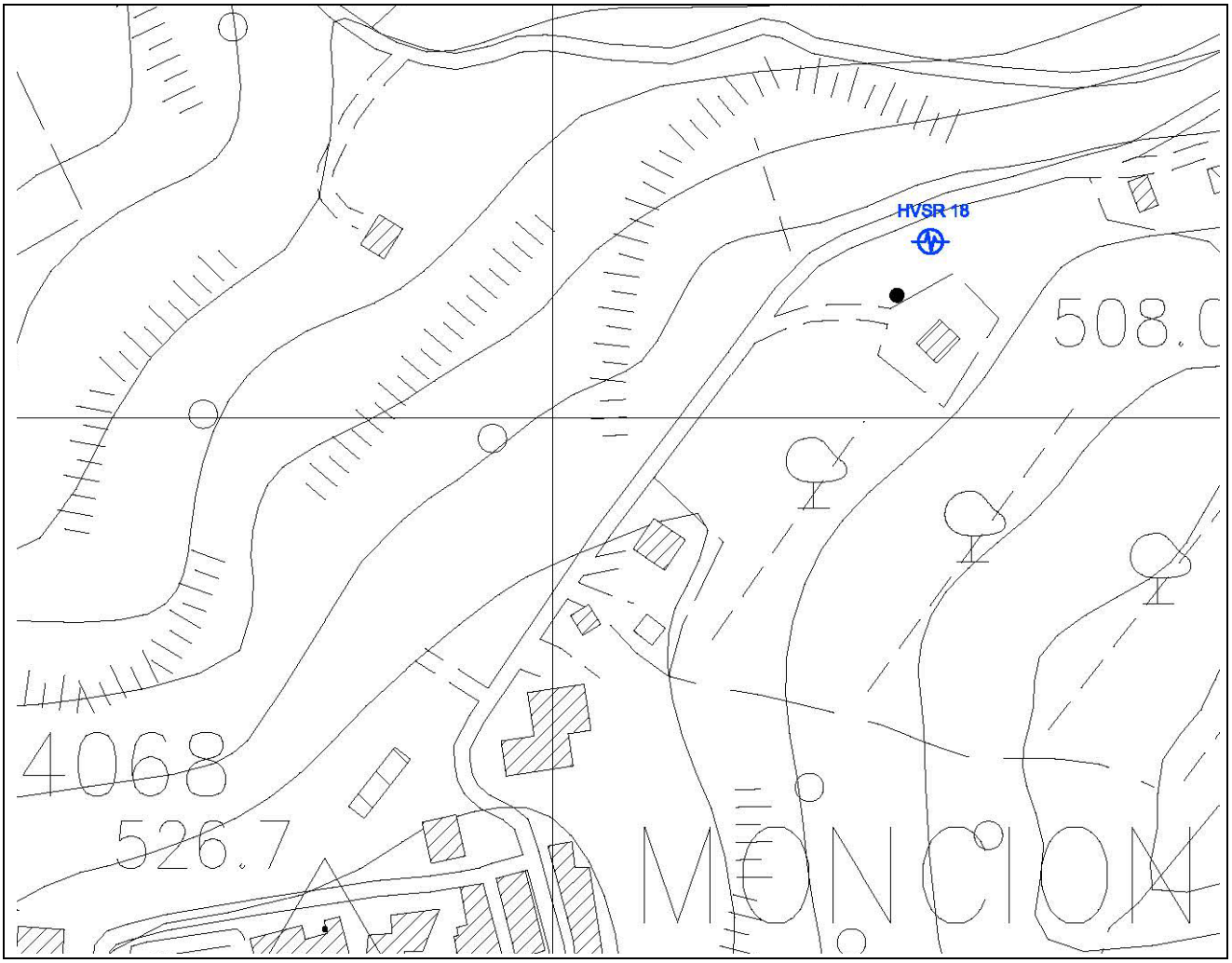


Figura 18.1 – individuazione del sito di studio - scala 1:2.000

Figura 18.2: rilievo sismico

H/V Spectral ratio

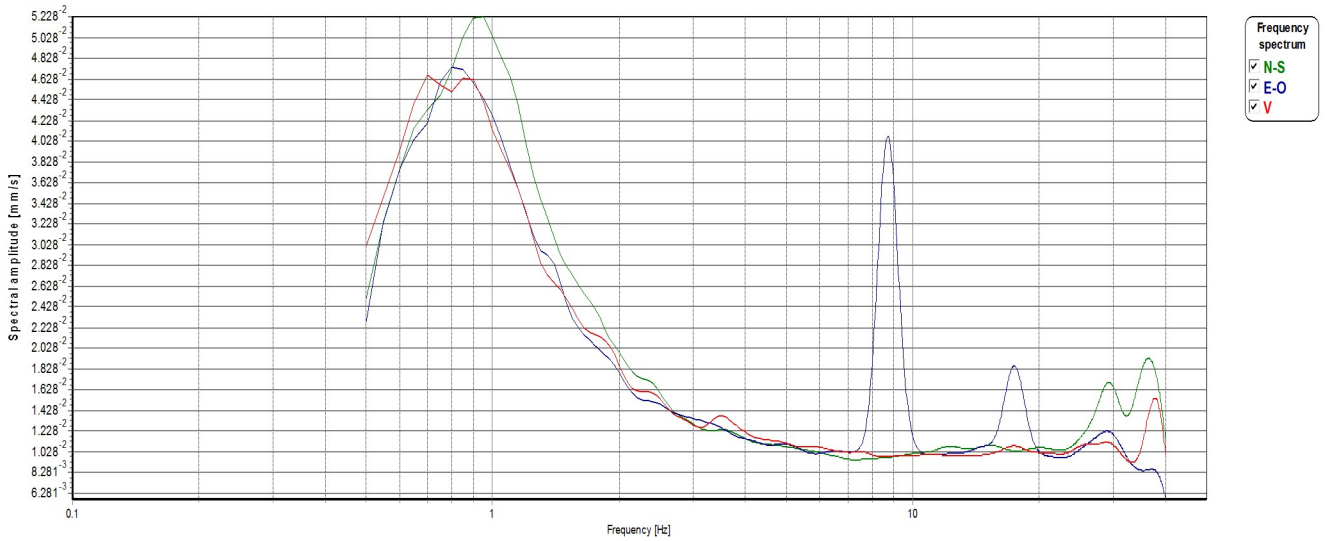
Analysis site: **Montevarchi**

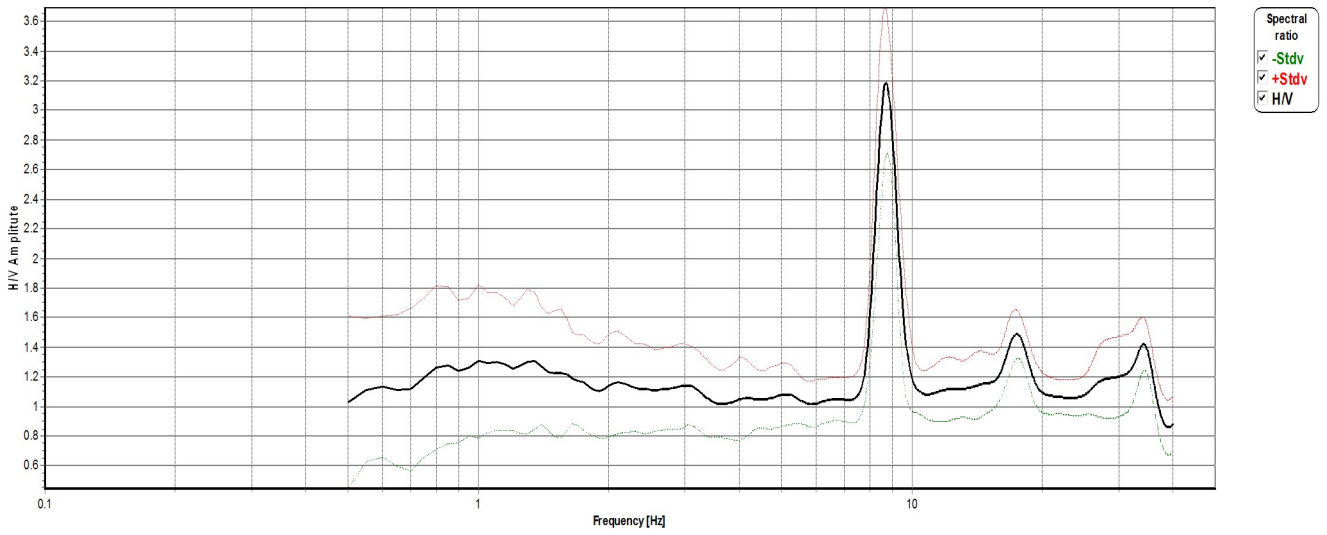
Measure point: **18 Moncioni**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**23/02/2021 17:42:32**
Automatic spike removal:	**No**	Stop recordings:	**23/02/2021 18:17:32**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**79**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**26**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**8.741**	Standard deviation [Hz]:	**0.174**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **18 Moncioni**

Criteria for a reliable H/V curve		
fø > 10/Lw	**8.74 >= 0.50**	**Yes**
Nc(fø) > 200	**13811.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 262**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**2.200**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**9.600**	**Yes**
Aø > 2	**3.18 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**1.04% < 5.00%**	**Yes**
sf < e(fø)	**0.1735 < 0.4371**	**Yes**
sA(fø) < ?(fø)	**0.4715 < 1.5800**	**Yes**

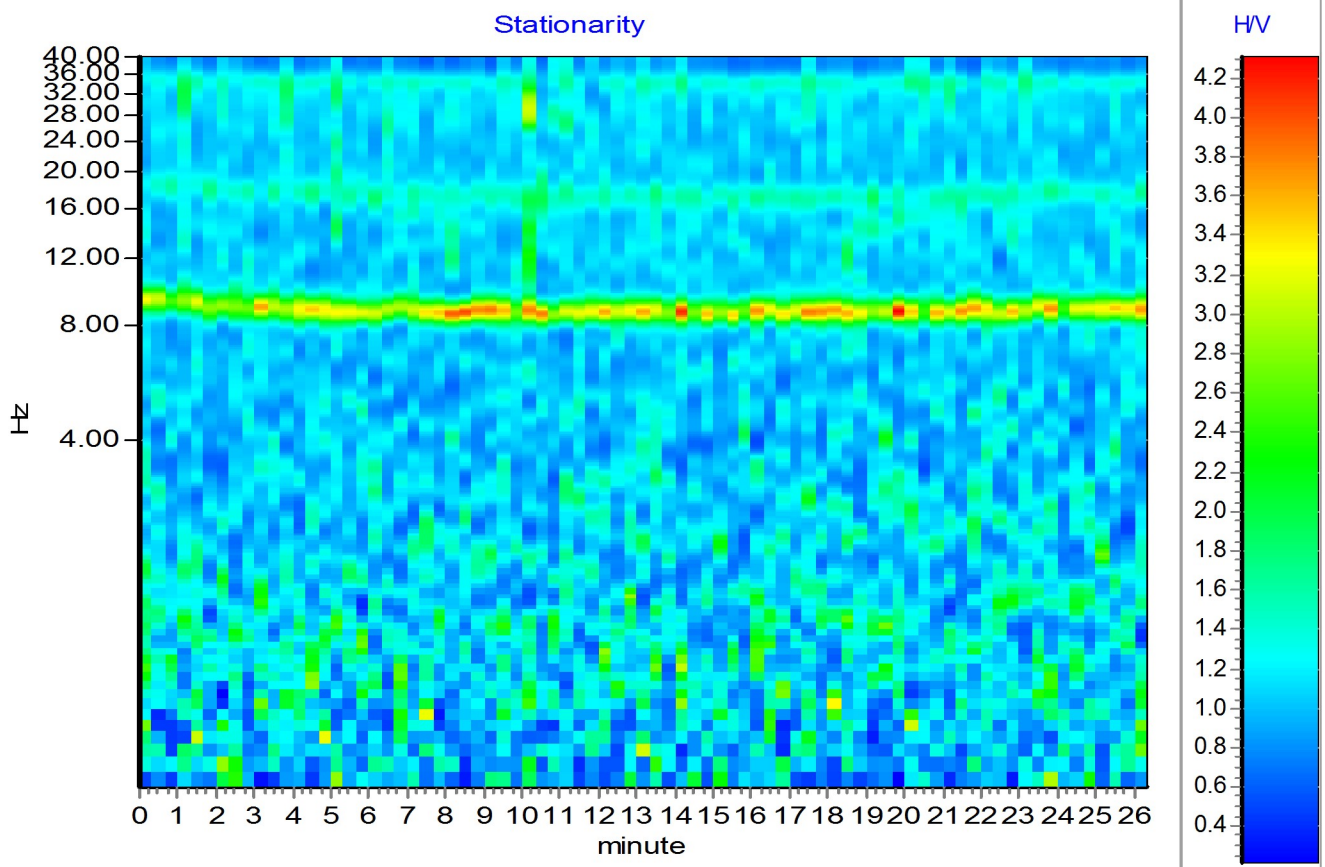
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

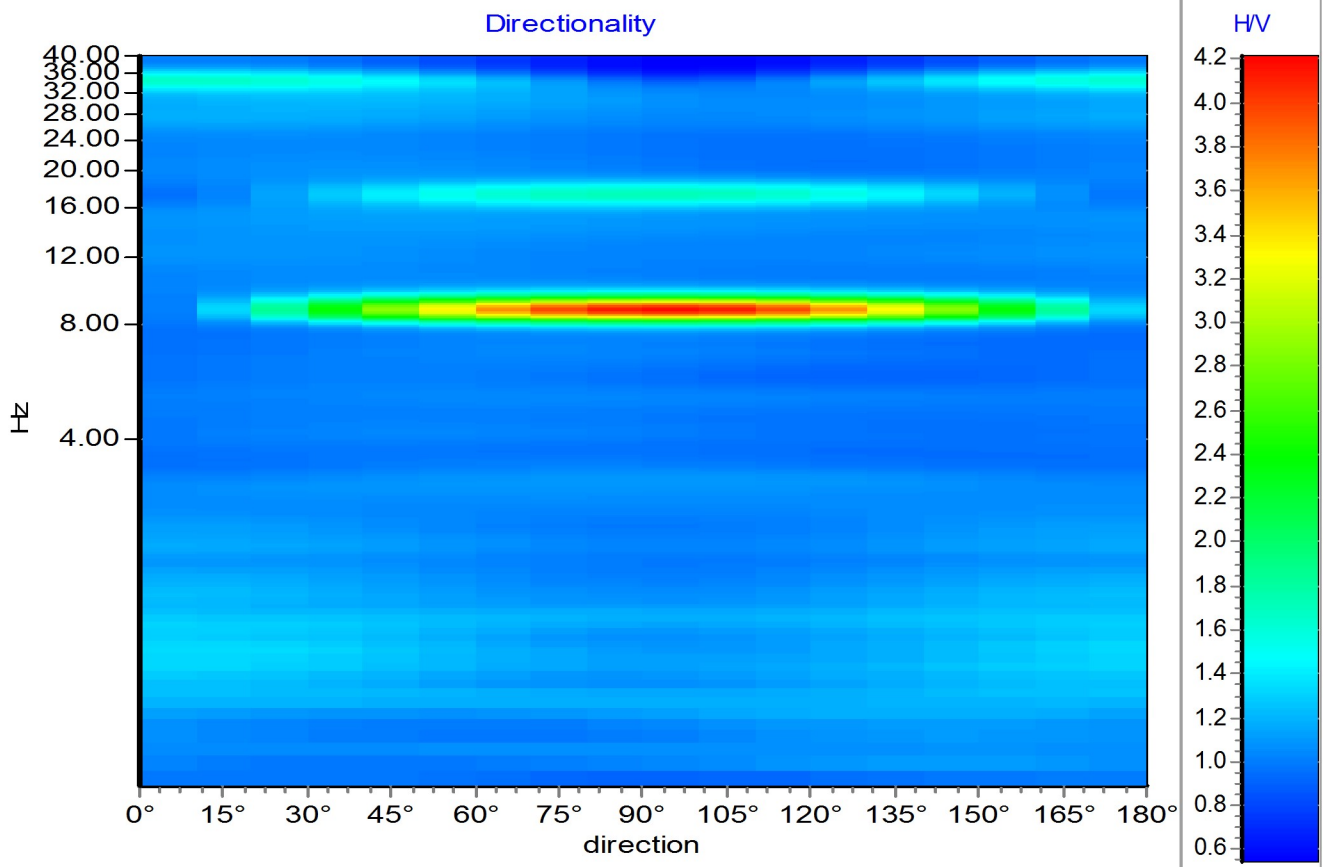
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **18 Moncioni**





Misura 19 HVRS

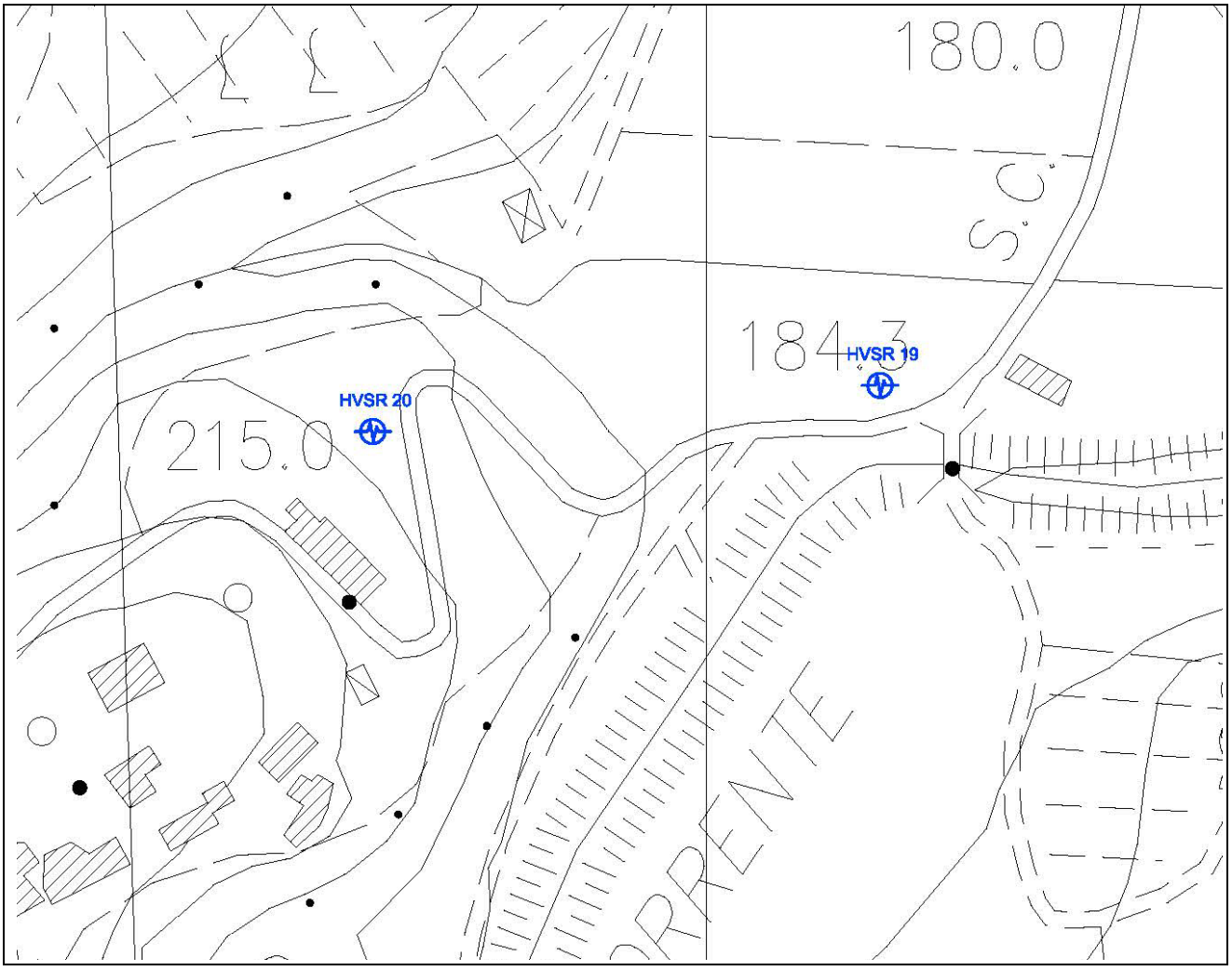


Figura 19.1 – individuazione del sito di studio - scala 1:2.000

Figura 19.2: rilievo sismico

H/V Spectral ratio

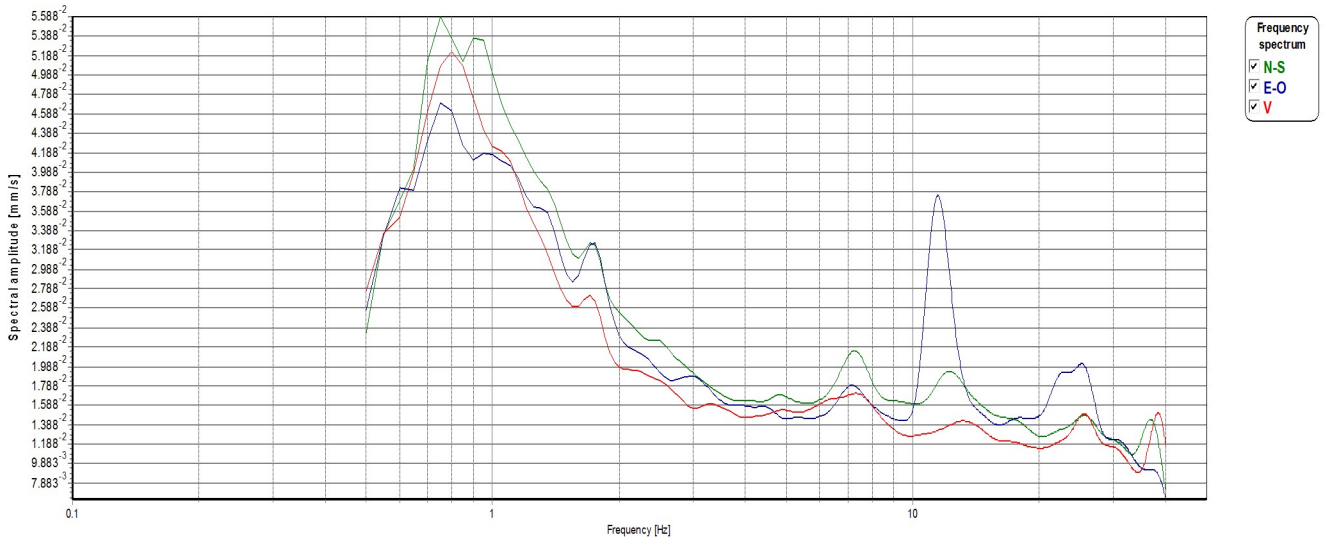
Analysis site: **Montevarchi**

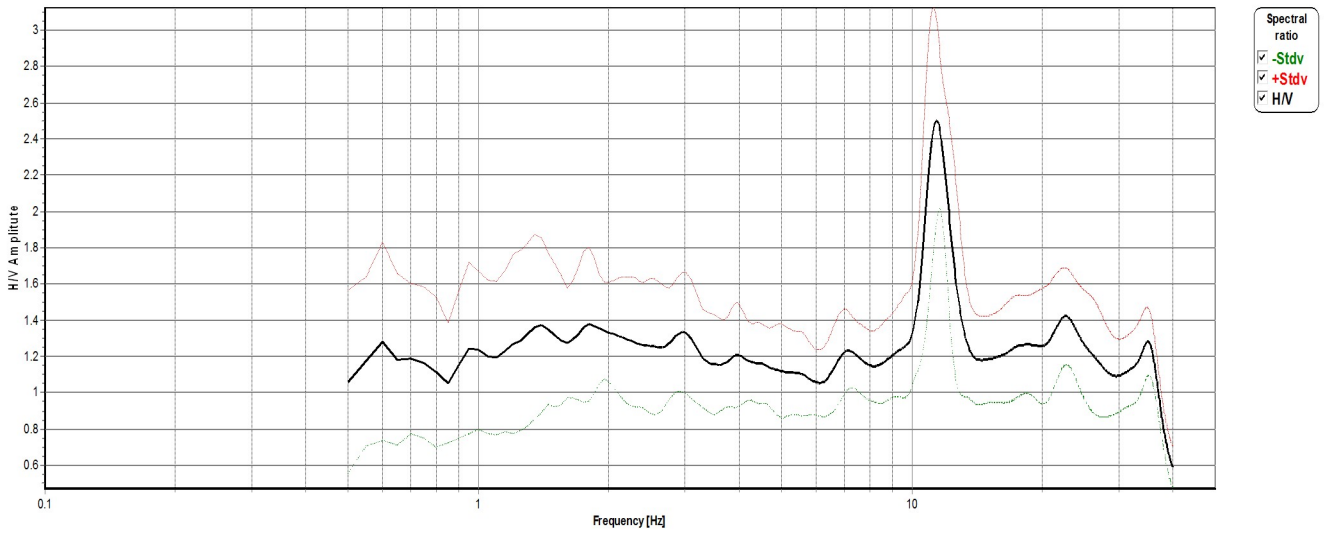
Measure point: **19 Caposelvi**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 10:10:08**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 10:40:08**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**44**
Lw Windows [s]:	**20**	Recording length [s]:	**1800**
Overlap Windows s]:	**0.0**	Discarded windows:	**46**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**11.542**	Standard deviation [Hz]:	**0.456**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **19 Caposelvi**

Criteria for a reliable H/V curve		
fø > 10/Lw	**11.54 >= 0.50**	**Yes**
Nc(fø) > 200	**10157.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 346**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**3.250**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**13.600**	**Yes**
Aø > 2	**2.47 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**2.96% < 5.00%**	**Yes**
sf < e(fø)	**0.4555 < 0.5771**	**Yes**
sA(fø) < ?(fø)	**0.4496 < 1.5800**	**Yes**

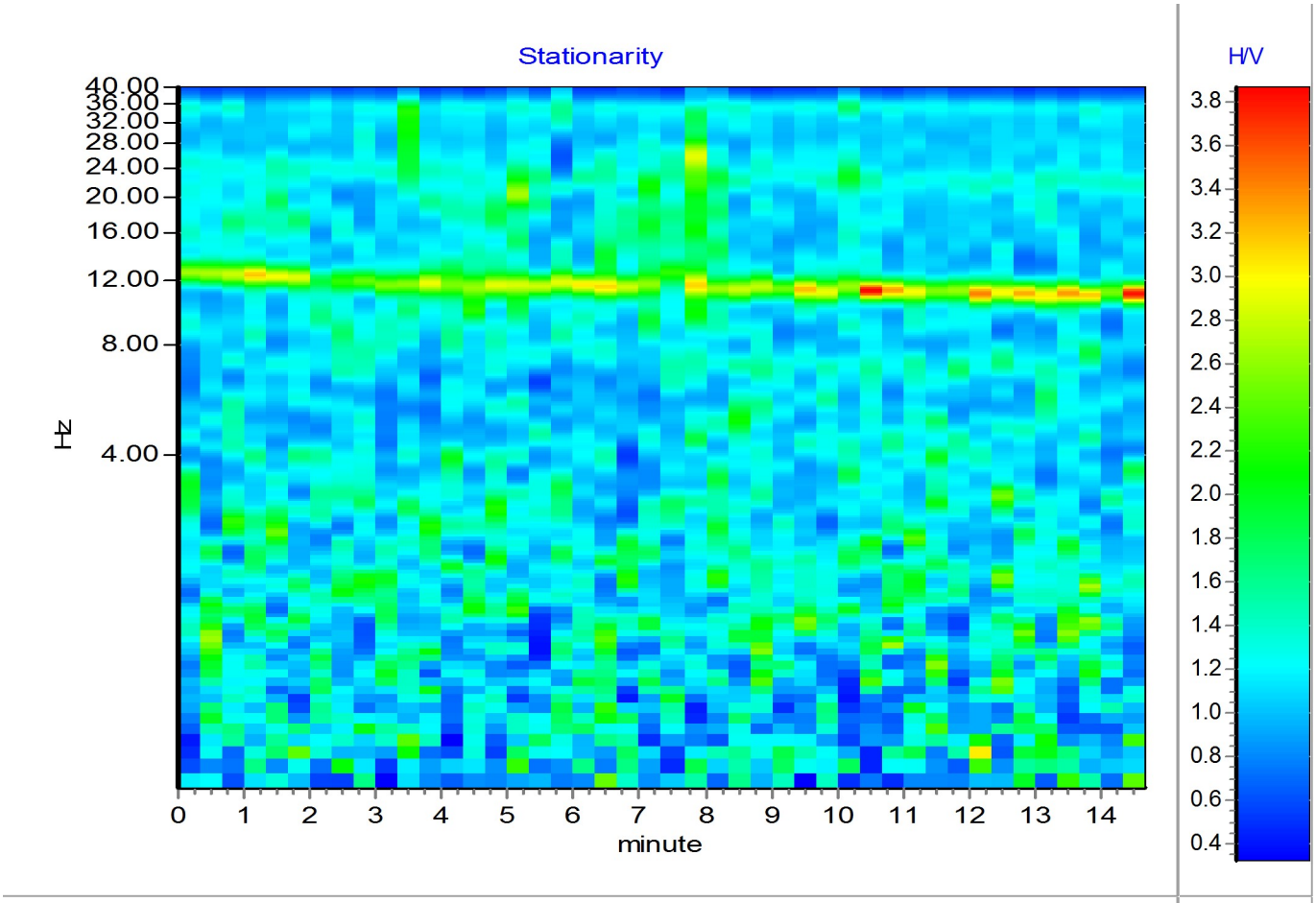
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

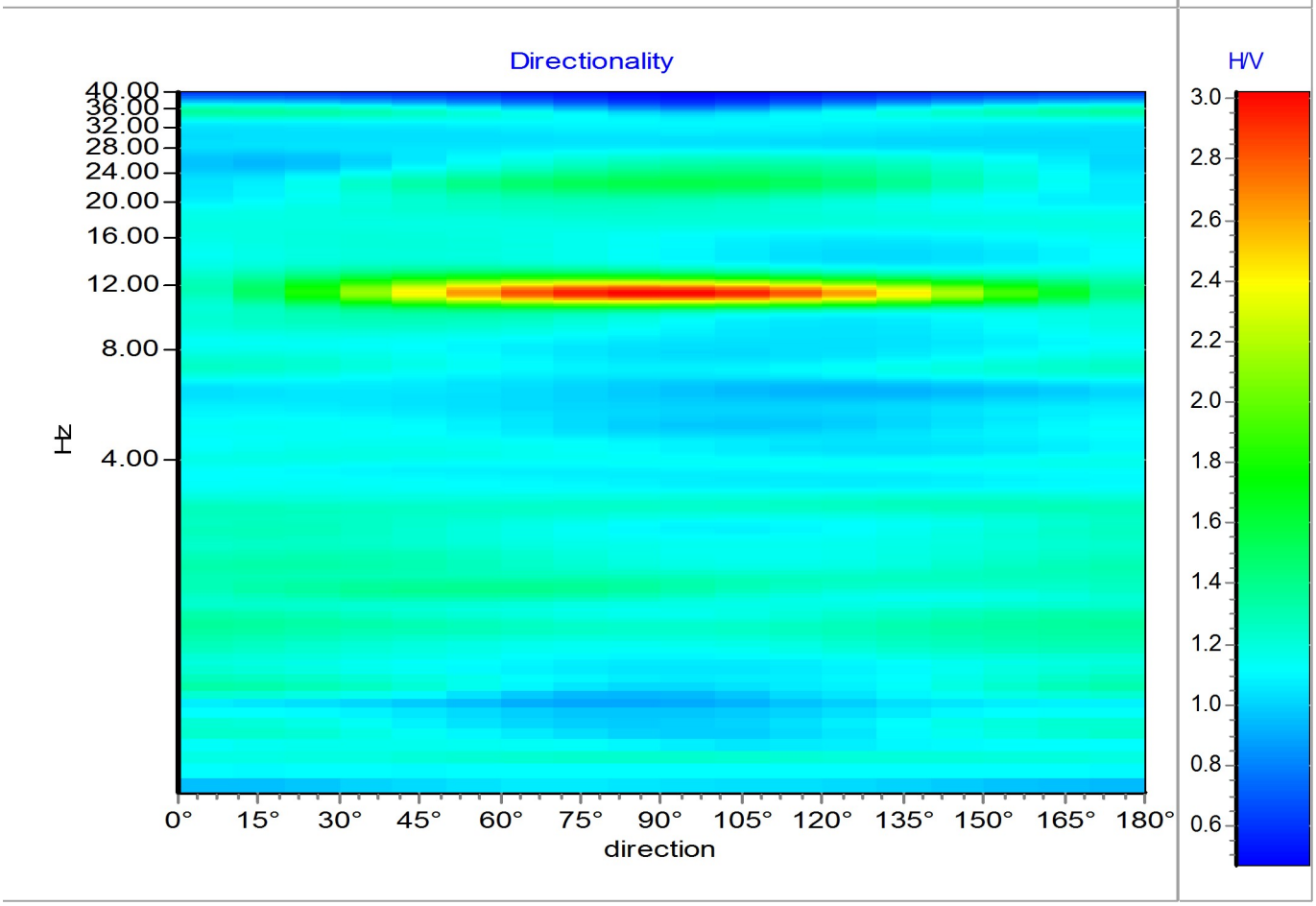
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **19 Caposelvi**





Misura 20 HVRS

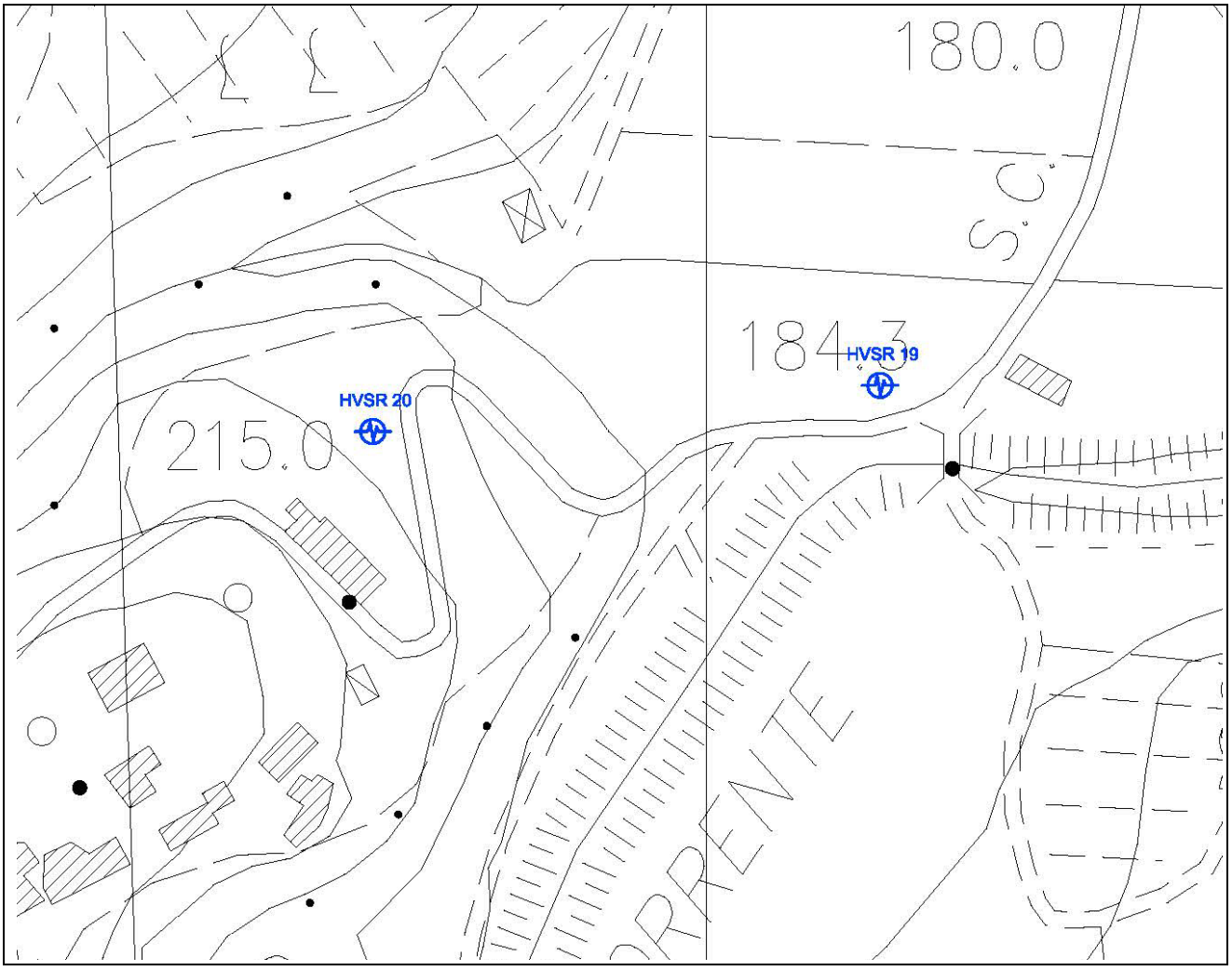


Figura 20.1 – individuazione del sito di studio - scala 1:2.000

Figura 20.2: rilievo sismico

H/V Spectral ratio

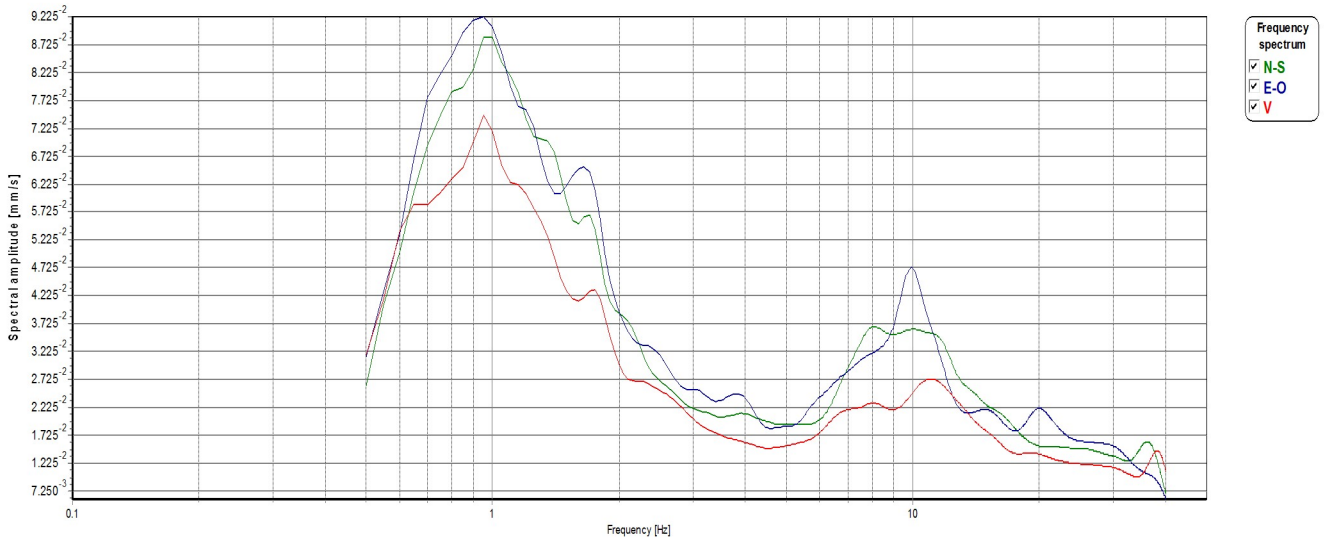
Analysis site: **Montevarchi**

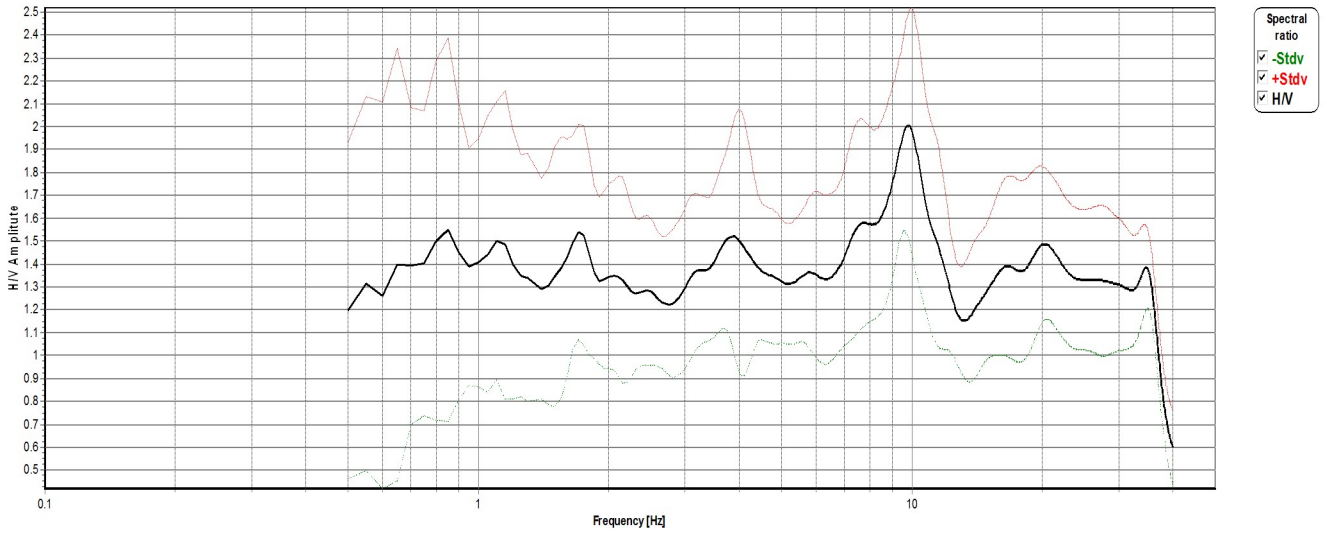
Measure point: **20 Caposelvi**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 10:52:20**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 11:27:20**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**85**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**20**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**3.886**	Standard deviation [Hz]:	**4.024**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **20 Caposelvi**

Criteria for a reliable H/V curve		
fø > 10/Lw	**3.89 >= 0.50**	**Yes**
Nc(fø) > 200	**6606.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 117**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.52 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**156.06% > 5.00%**	**No**
sf < e(fø)	**4.0235 > 0.1943**	**No**
sA(fø) < ?(fø)	**0.5250 < 1.5800**	**Yes**

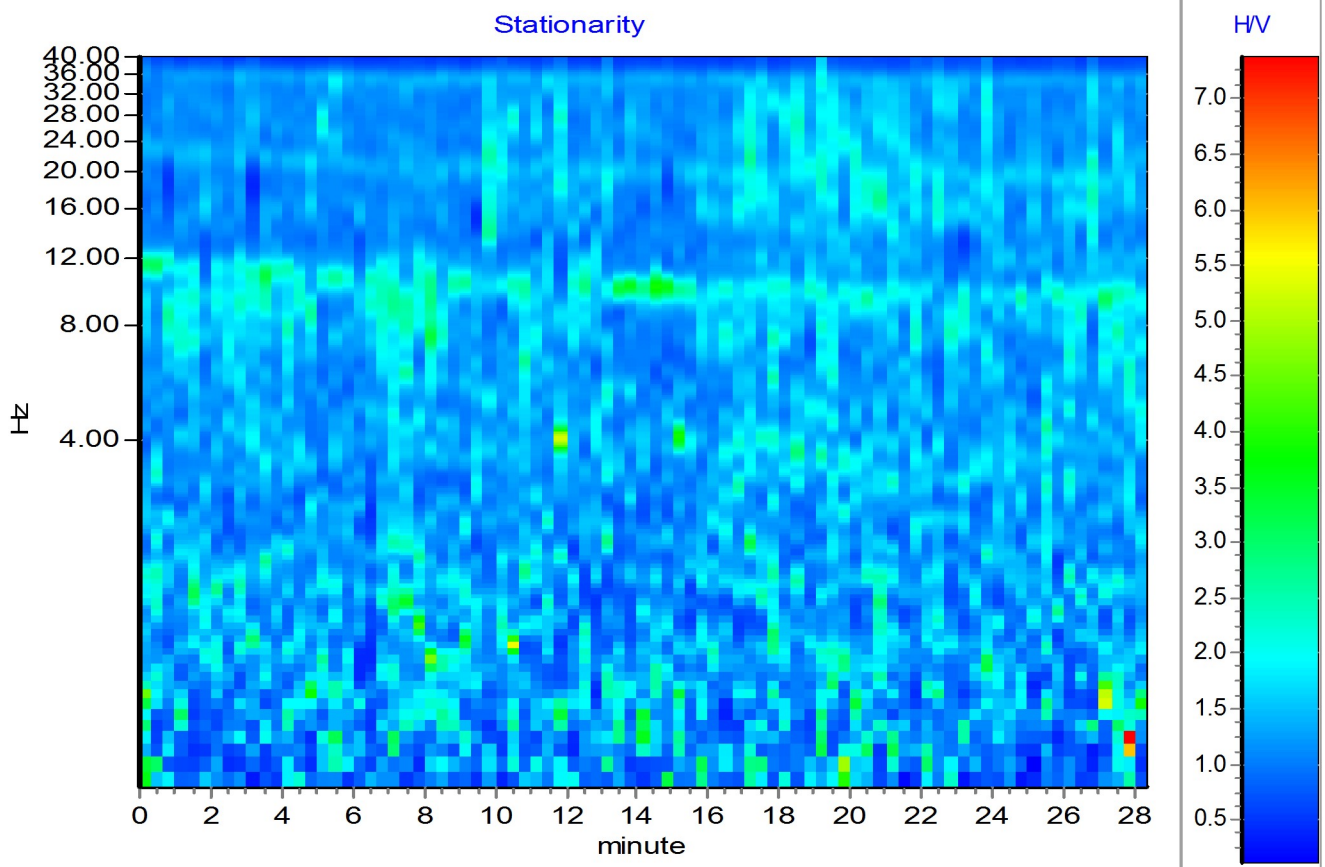
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

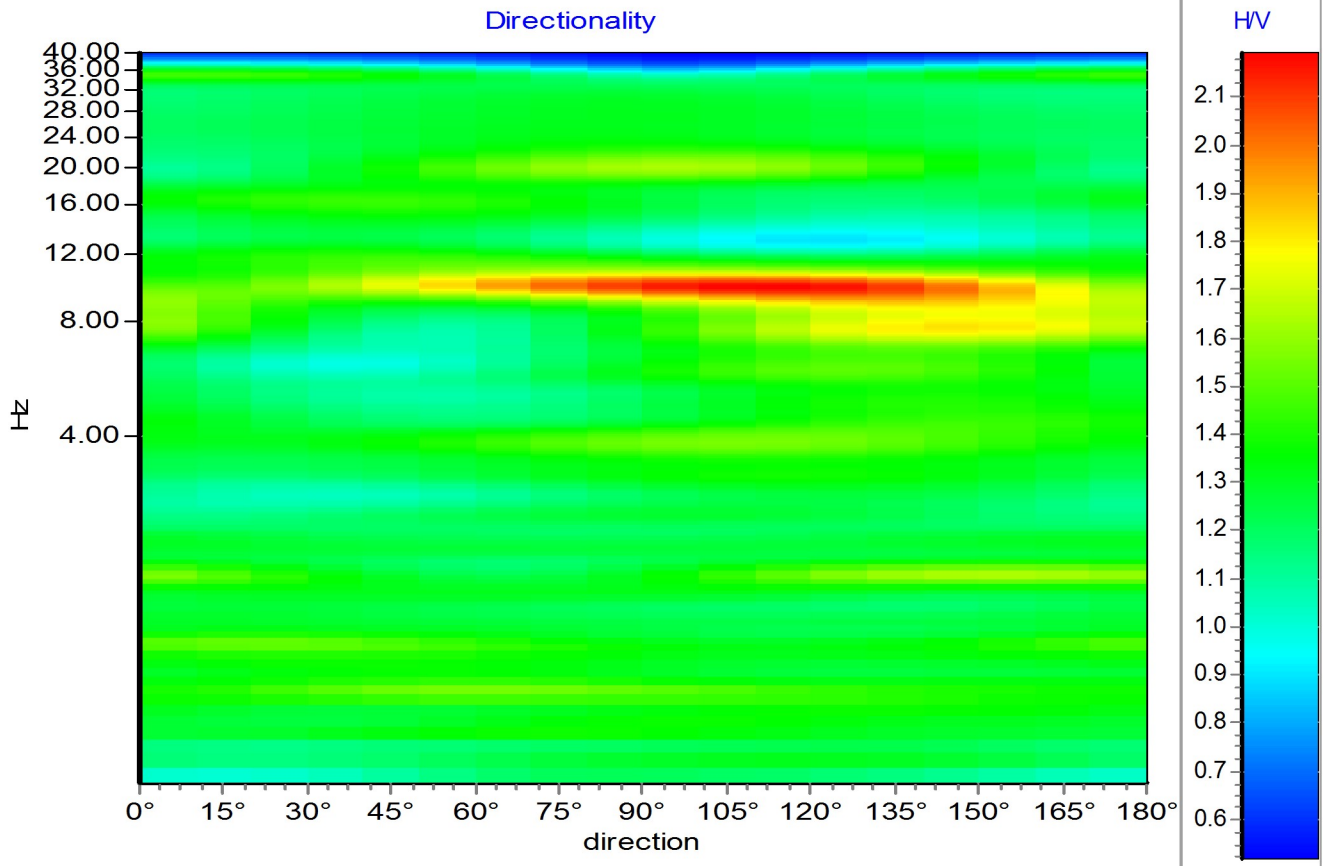
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **20 Caposelvi**





Misura 21 HVRS

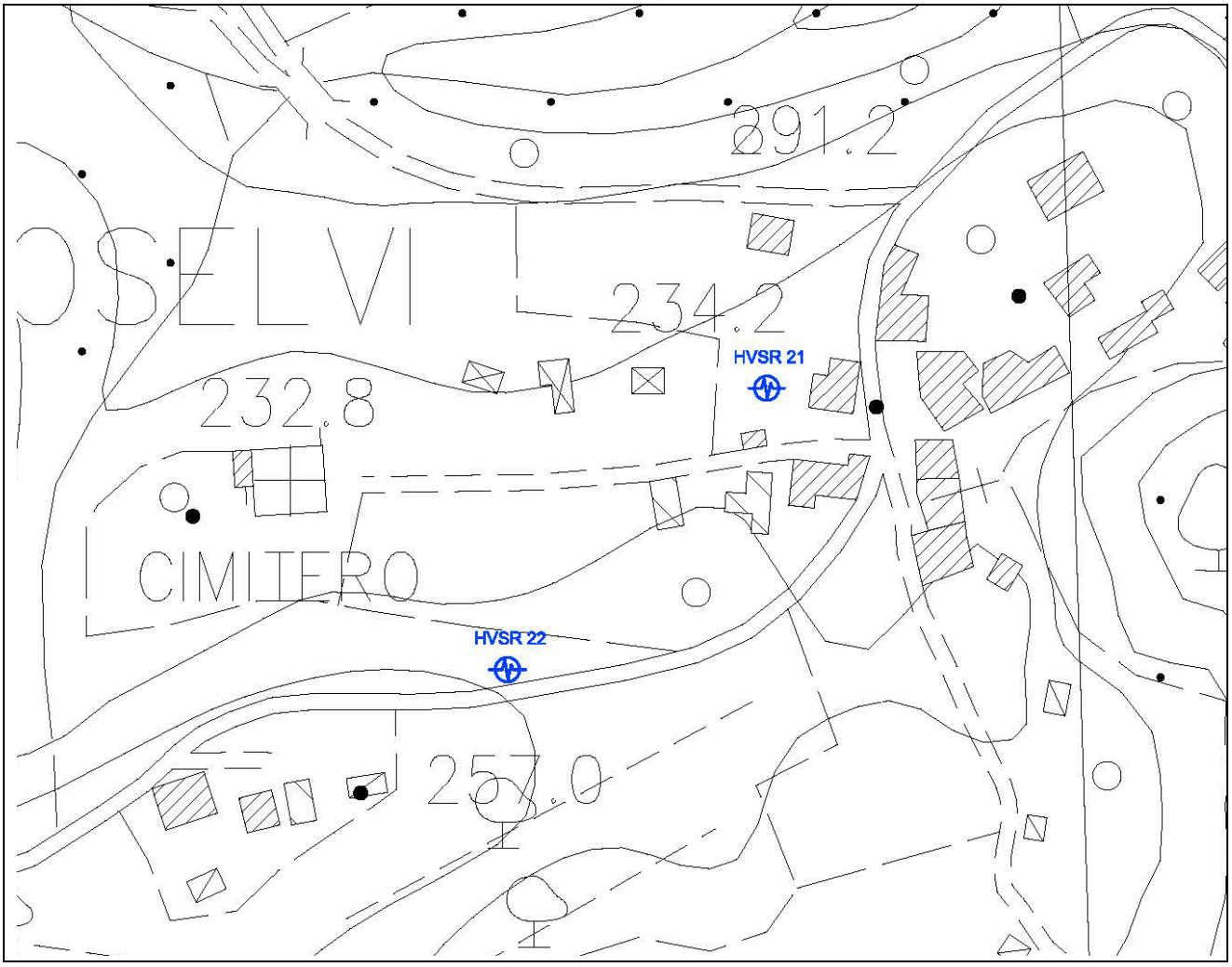


Figura 21.1 – individuazione del sito di studio - scala 1:2.000

Figura 21.2: rilievo sismico

H/V Spectral ratio

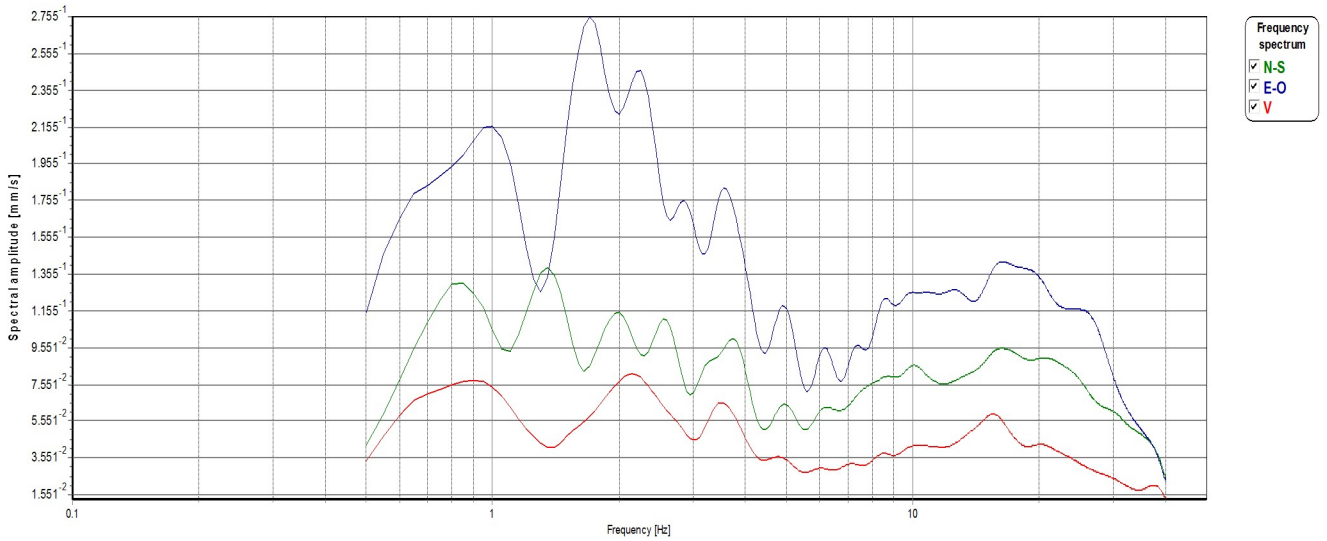
Analysis site: **Montevarchi**

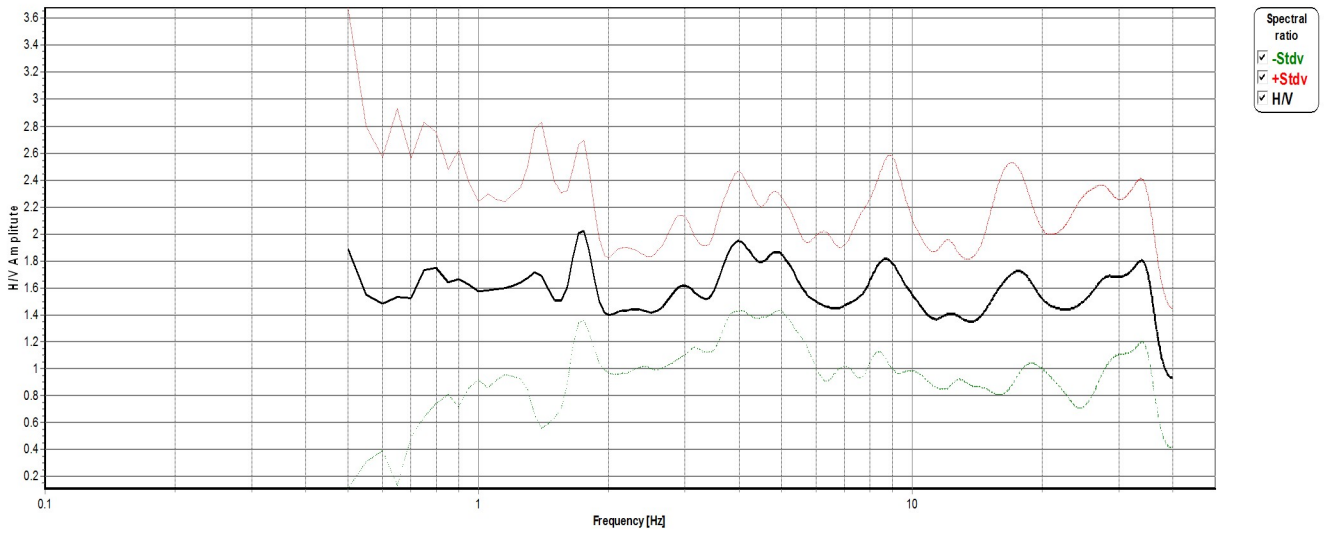
Measure point: **21 Caposelvi**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 11:37:50**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 12:12:50**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**96**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**9**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**2.947**	Standard deviation [Hz]:	**3.782**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **21 Caposelvi**

Criteria for a reliable H/V curve		
fø > 10/Lw	**2.95 >= 0.50**	**Yes**
Nc(fø) > 200	**5659.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 88**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.62 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**83.04% > 5.00%**	**No**
sf < e(fø)	**3.7822 > 0.1474**	**No**
sA(fø) < ?(fø)	**0.5263 < 1.5800**	**Yes**

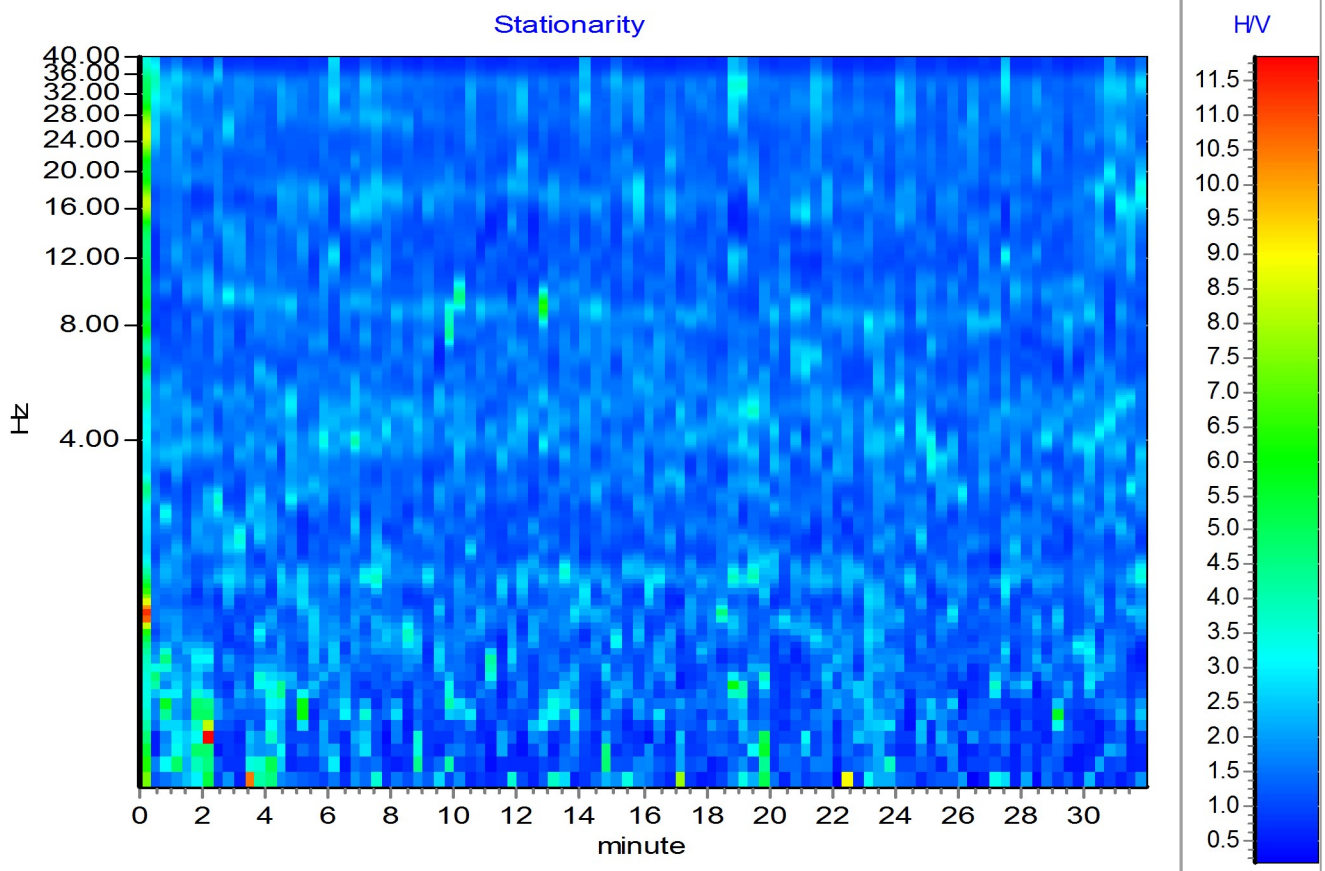
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

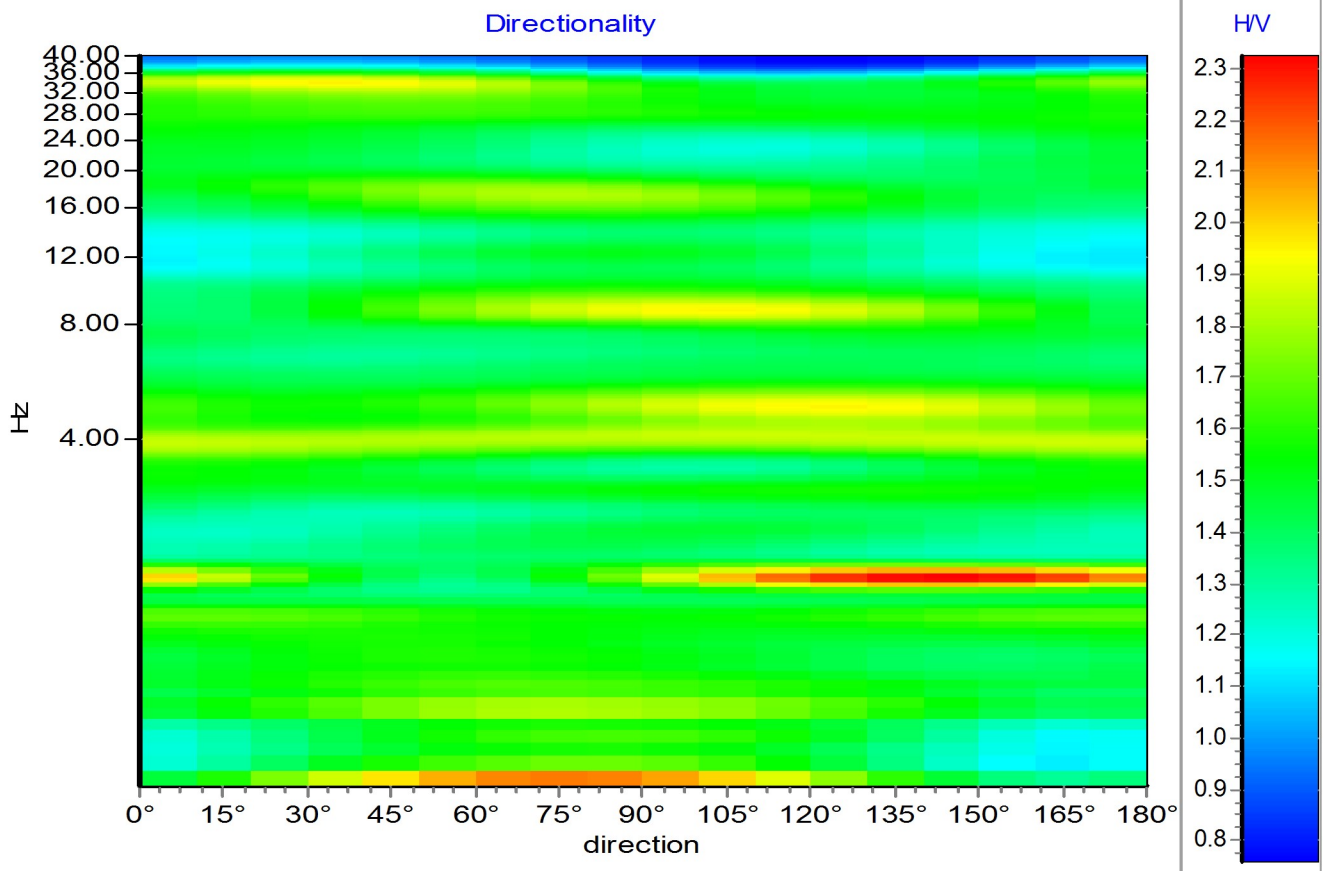
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **21 Caposelvi**





Misura 22 HVRS

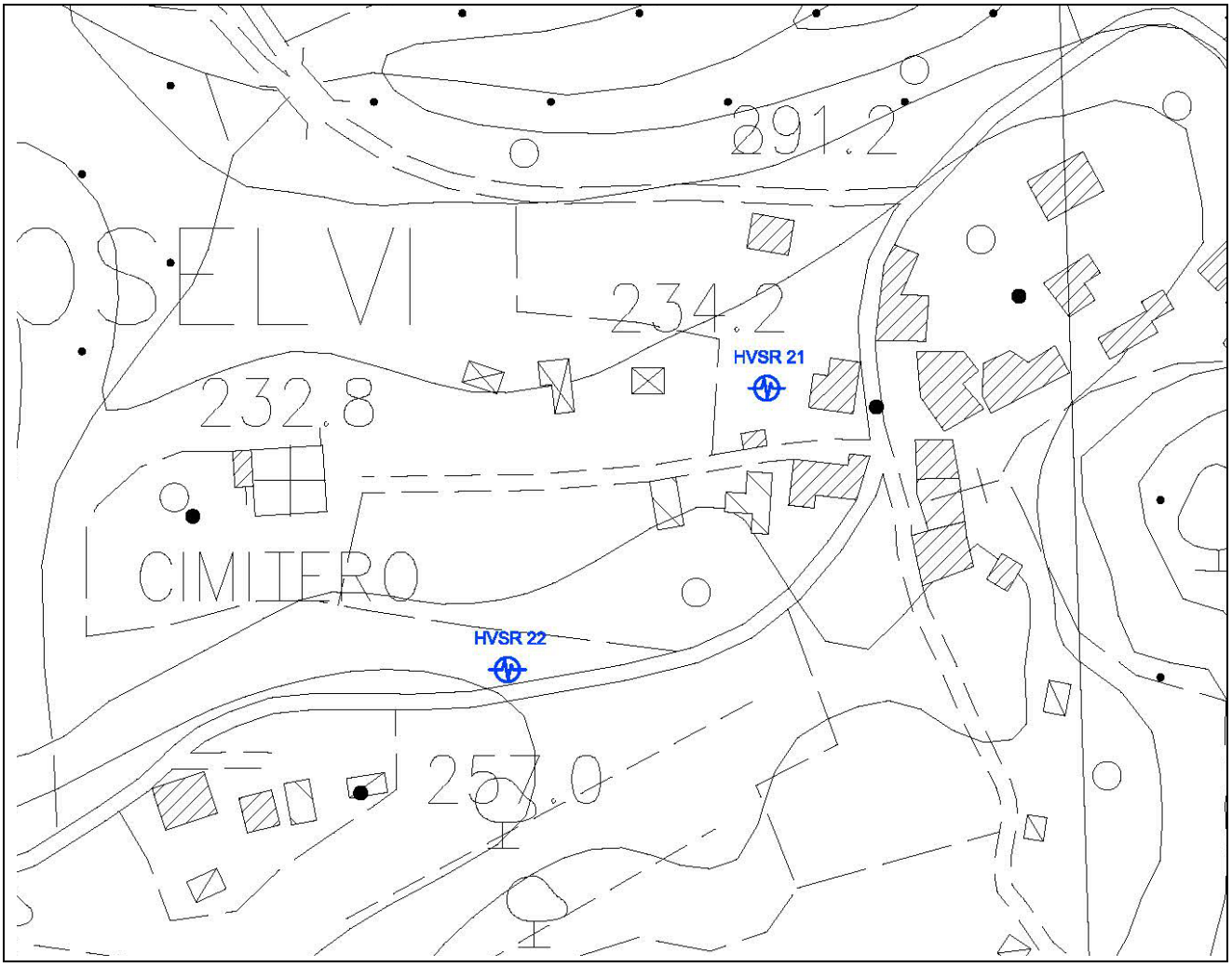


Figura 22.1 – individuazione del sito di studio - scala 1:2.000

Figura 22.2: rilievo sismico

H/V Spectral ratio

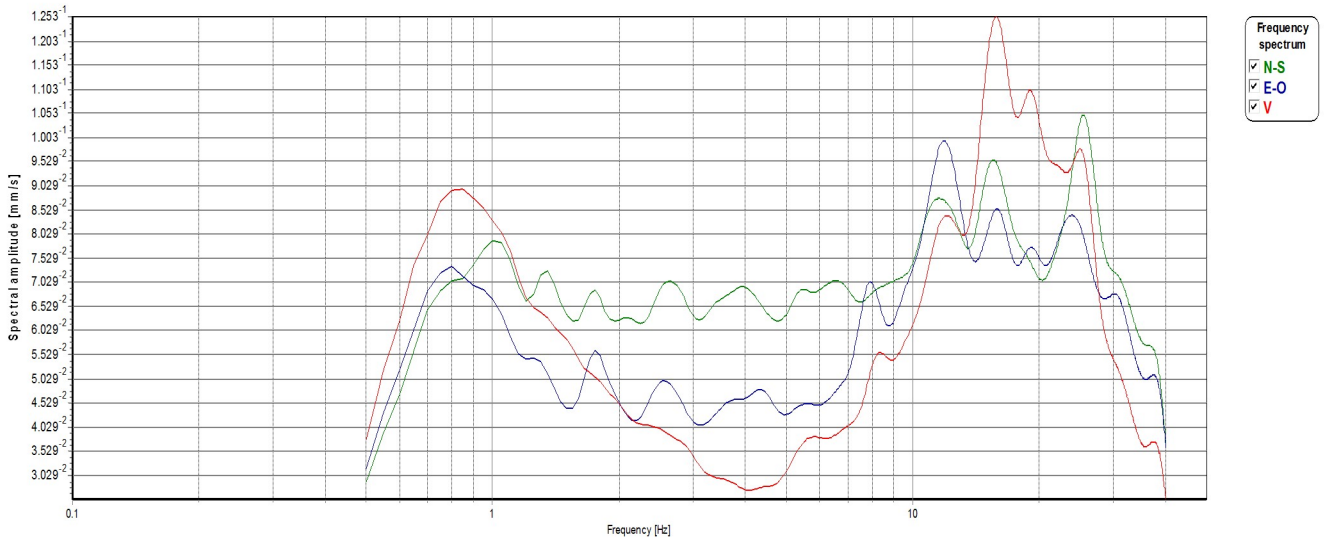
Analysis site: **Montevarchi**

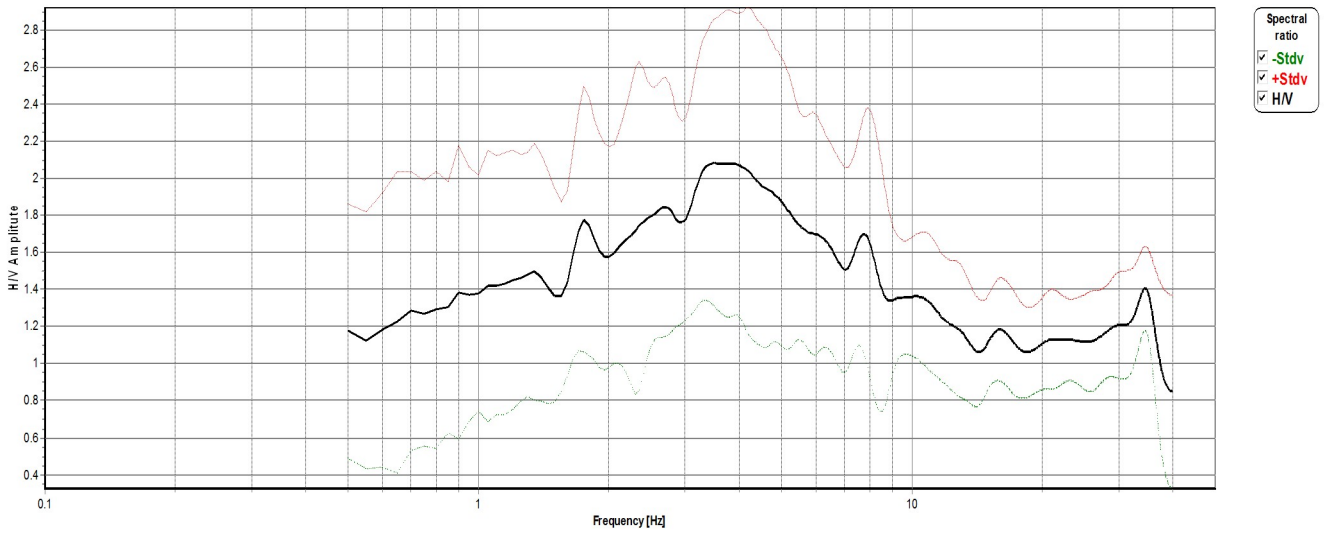
Measure point: **22 Caposelvi**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 12:24:36**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 12:59:36**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**94**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**11**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**2.546**	Standard deviation [Hz]:	**1.826**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **22 Caposelvi**

Criteria for a reliable H/V curve		
fø > 10/Lw	**2.55 >= 0.50**	**Yes**
Nc(fø) > 200	**4786.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 76**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.81 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**64.98% > 5.00%**	**No**
sf < e(fø)	**1.8263 > 0.1273**	**No**
sA(fø) < ?(fø)	**0.6782 < 1.5800**	**Yes**

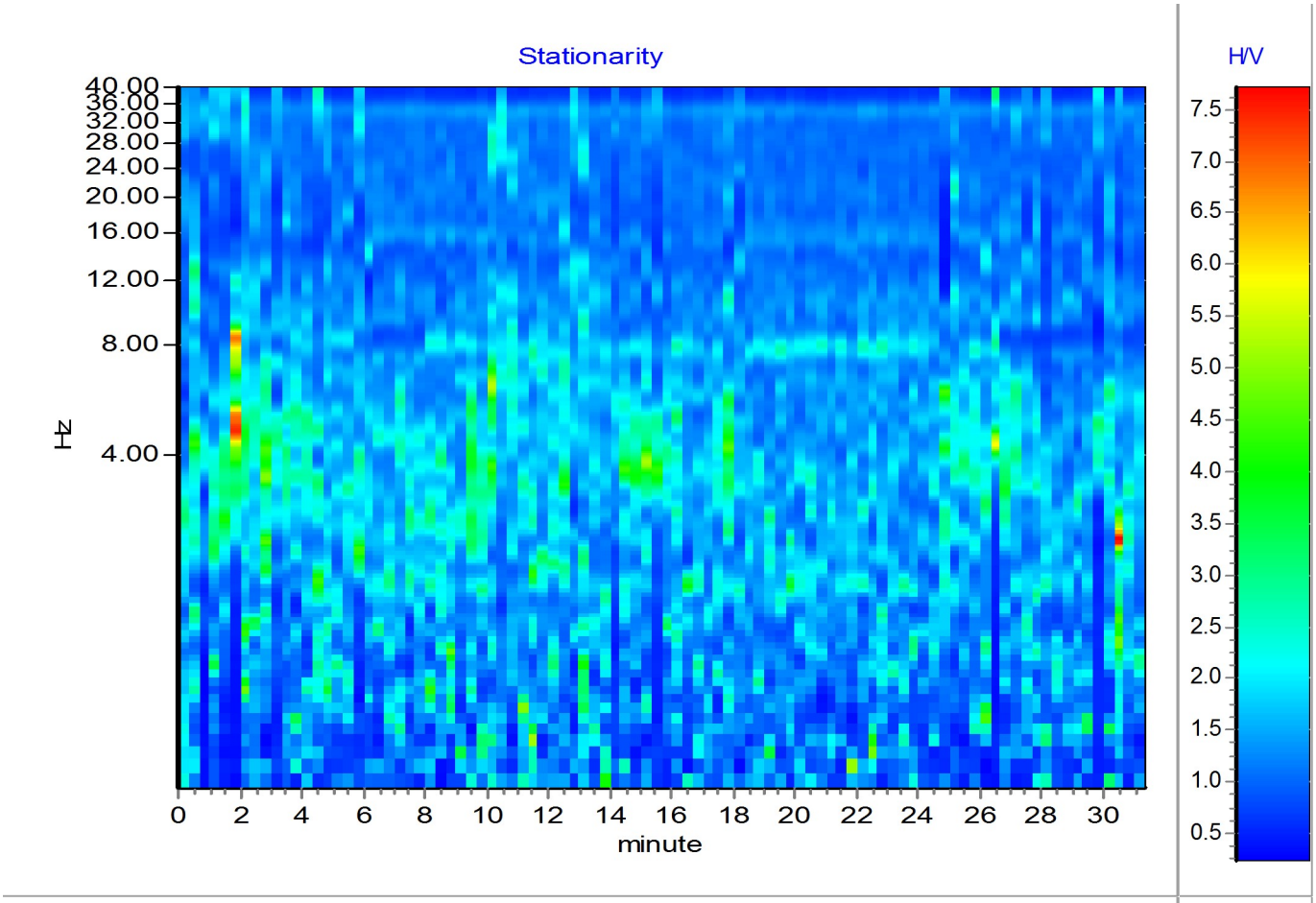
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

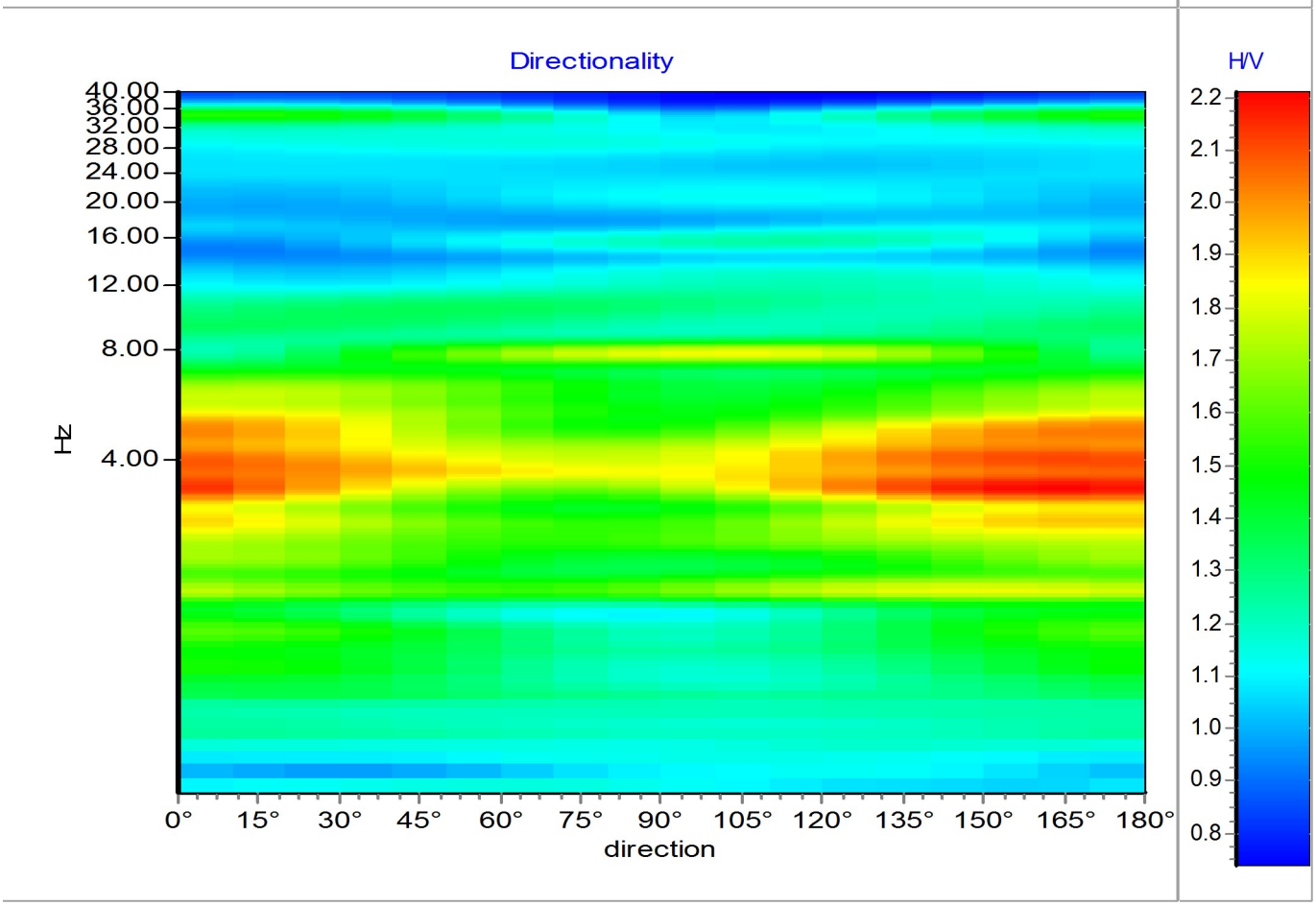
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **22 Caposelvi**





Misura 23 HVRS

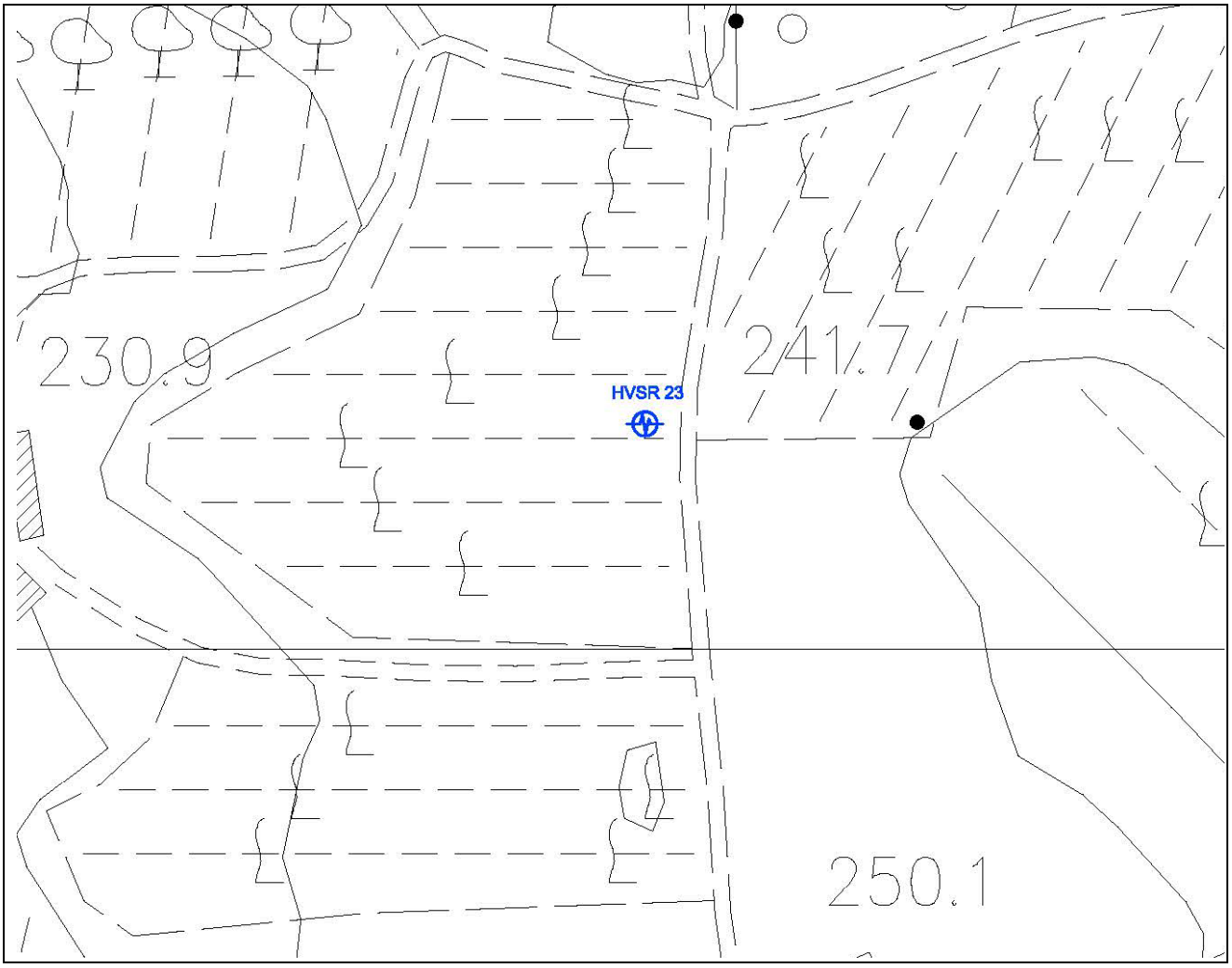


Figura 23.1 – individuazione del sito di studio - scala 1:2.000

Figura 23.2: rilievo sismico

H/V Spectral ratio

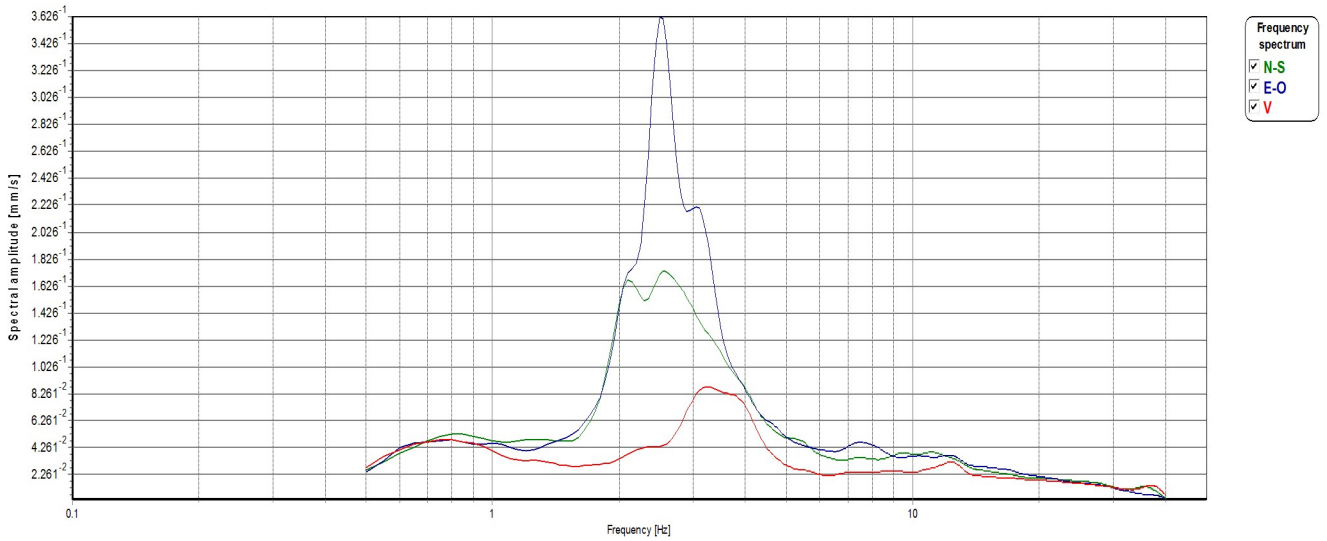
Analysis site: **Montevarchi**

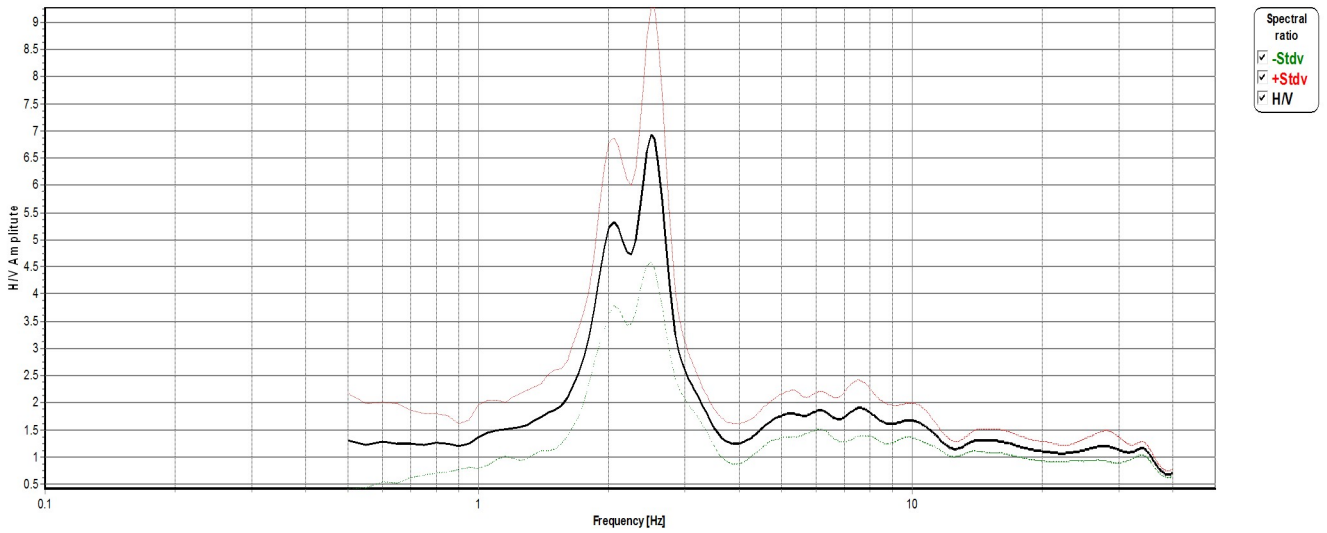
Measure point: **23 Levane**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 13:32:02**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 14:07:02**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**103**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**2**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**2.368**	Standard deviation [Hz]:	**0.226**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **23 Levane**

Criteria for a reliable H/V curve		
fø > 10/Lw	**2.37 >= 0.50**	**Yes**
Nc(fø) > 200	**4879.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 4 out of 71**	**No**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.600**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.950**	**Yes**
Aø > 2	**5.46 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**5.55% > 5.00%**	**No**
sf < e(fø)	**0.2258 > 0.1184**	**No**
sA(fø) < ?(fø)	**1.4639 < 1.5800**	**Yes**

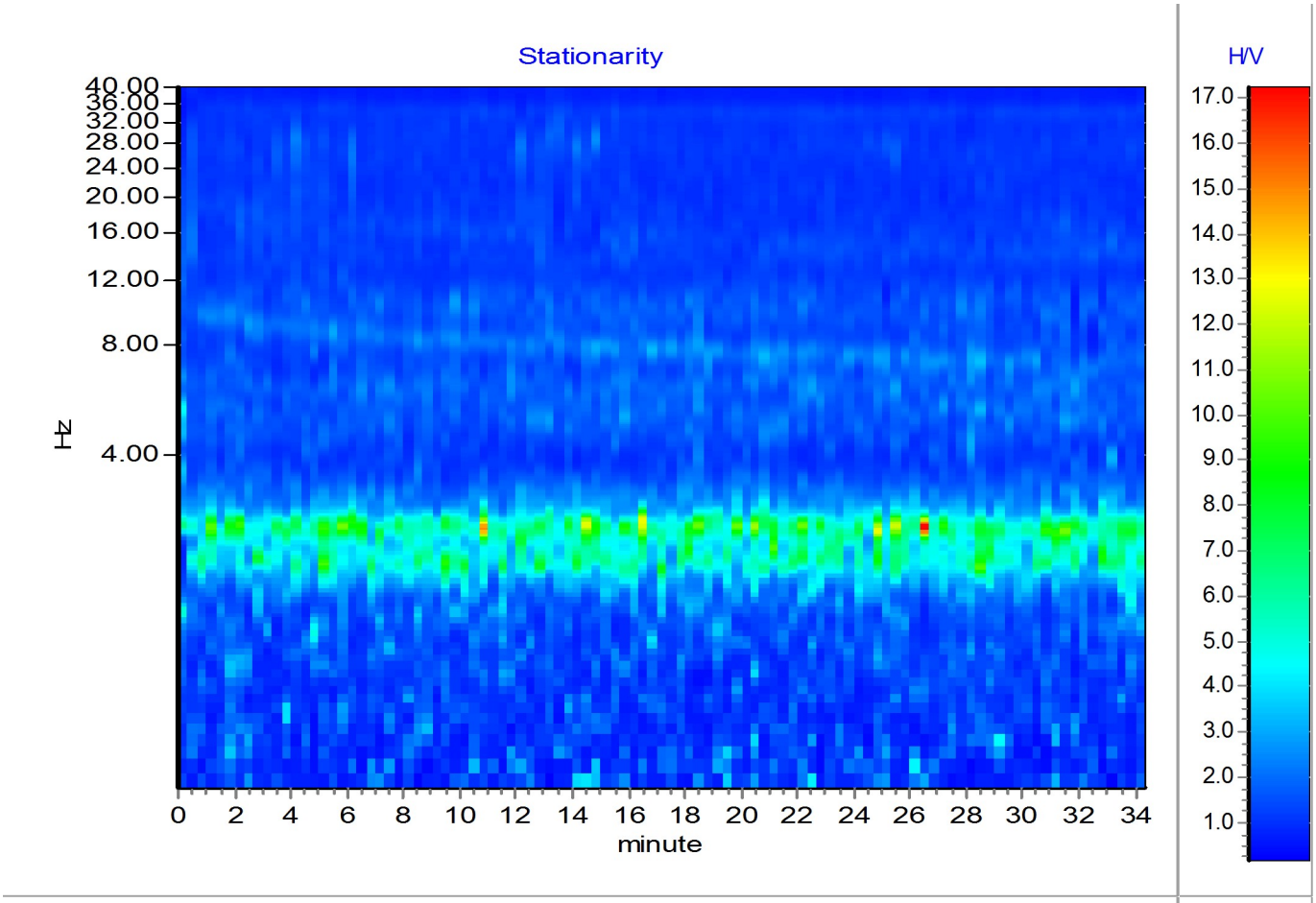
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

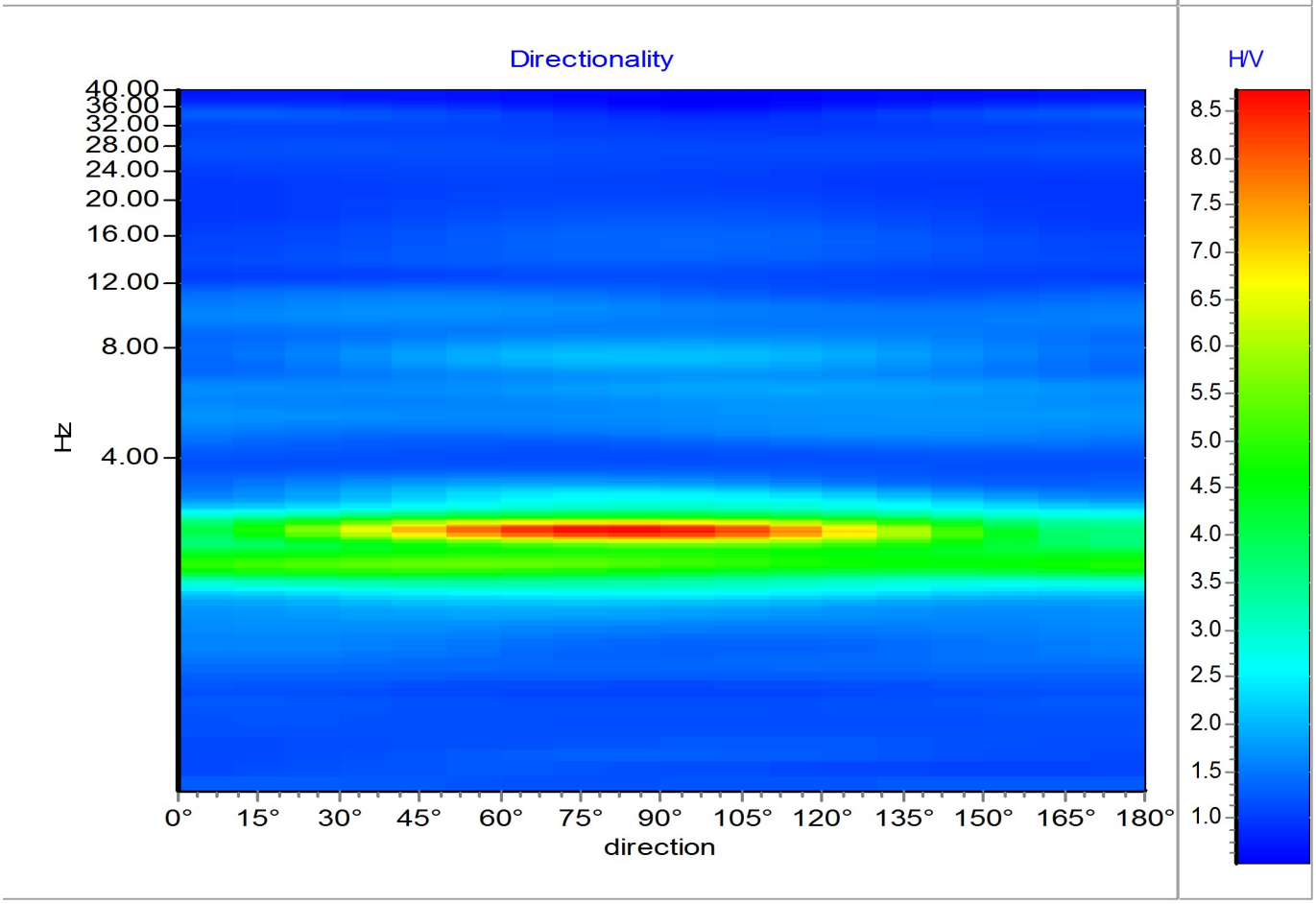
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **23 Levane**





Misura 24 HVRS

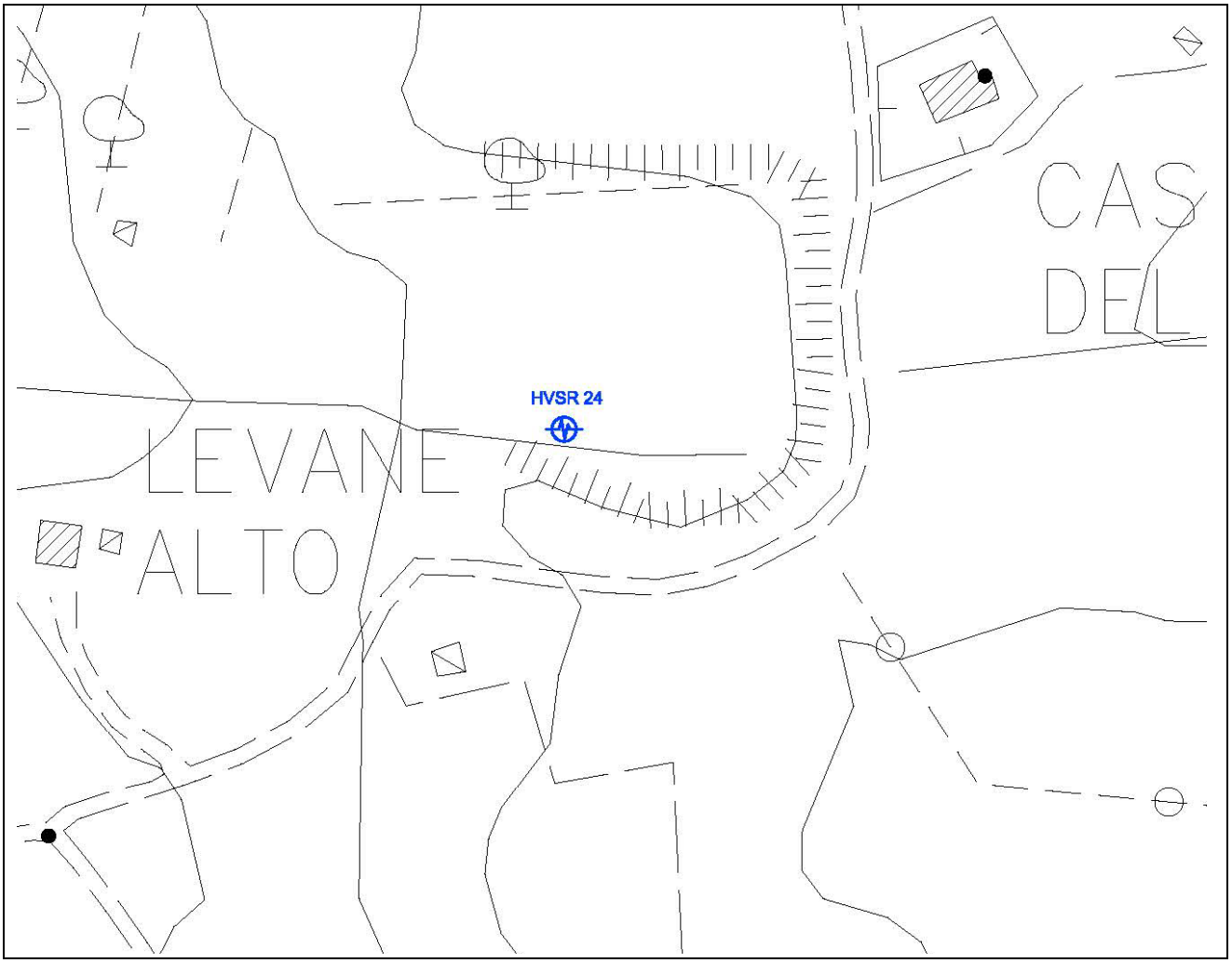


Figura 24.1 – individuazione del sito di studio - scala 1:2.000

Figura 24.2: rilievo sismico

H/V Spectral ratio

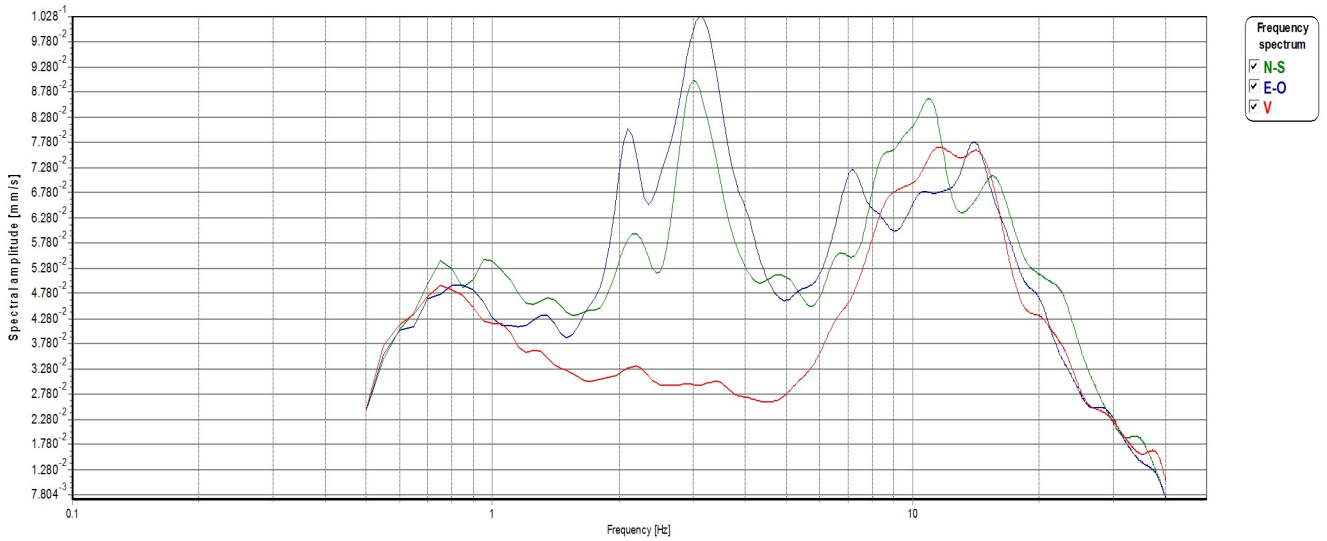
Analysis site: **Montevarchi**

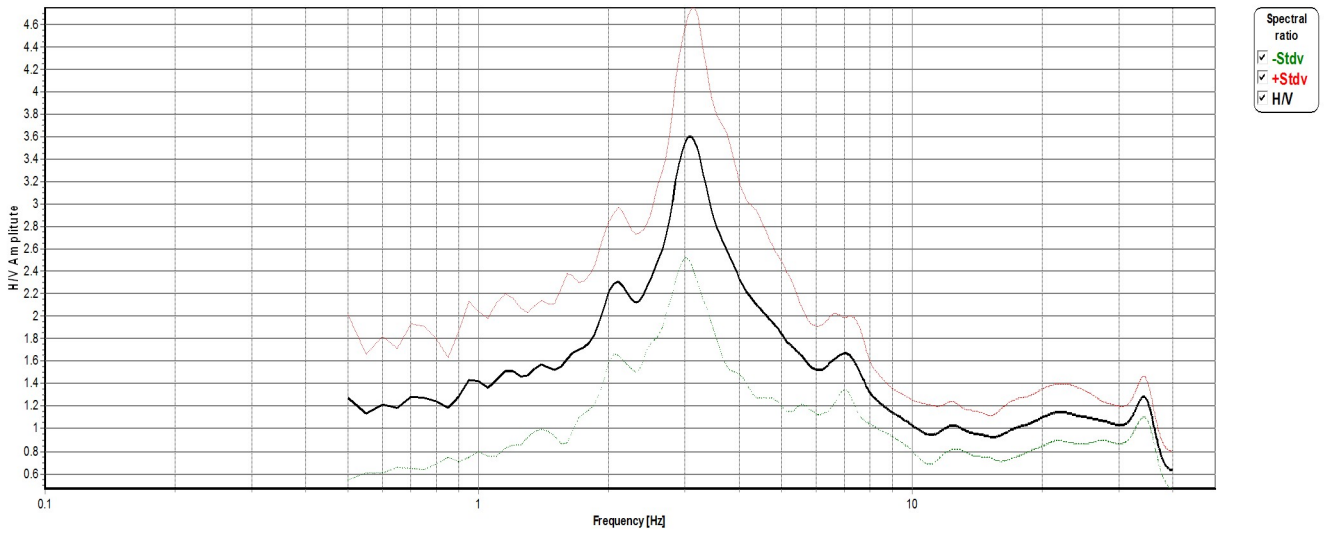
Measure point: **24 Levane**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 14:15:49**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 14:50:49**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**65**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**40**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**3.078**	Standard deviation [Hz]:	**0.270**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **24 Levane**

Criteria for a reliable H/V curve		
fø > 10/Lw	**3.08 >= 0.50**	**Yes**
Nc(fø) > 200	**4002.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 93**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.800**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**5.100**	**Yes**
Aø > 2	**3.60 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**2.55% < 5.00%**	**Yes**
sf < e(fø)	**0.2698 > 0.1539**	**No**
sA(fø) < ?(fø)	**1.1461 < 1.5800**	**Yes**

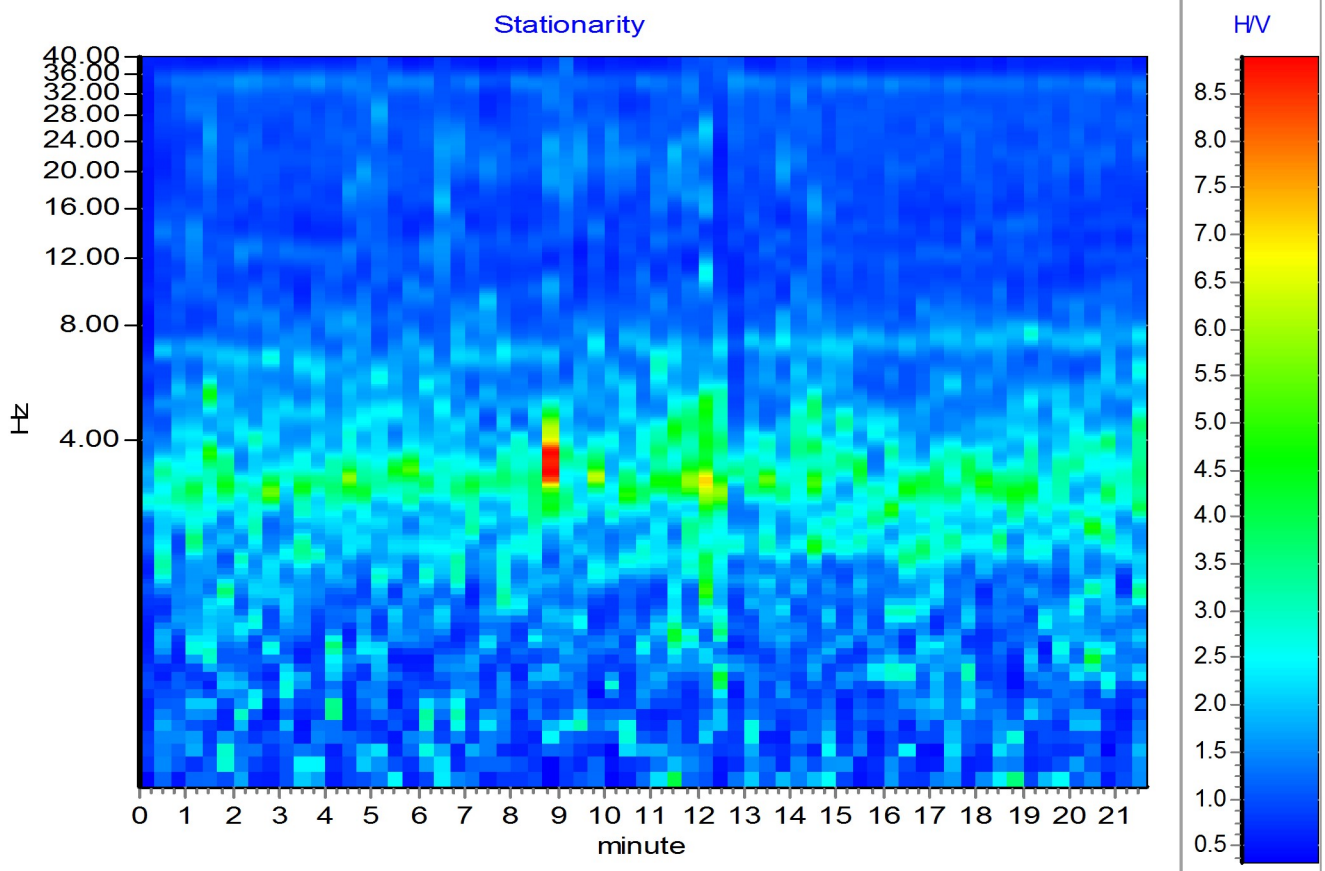
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

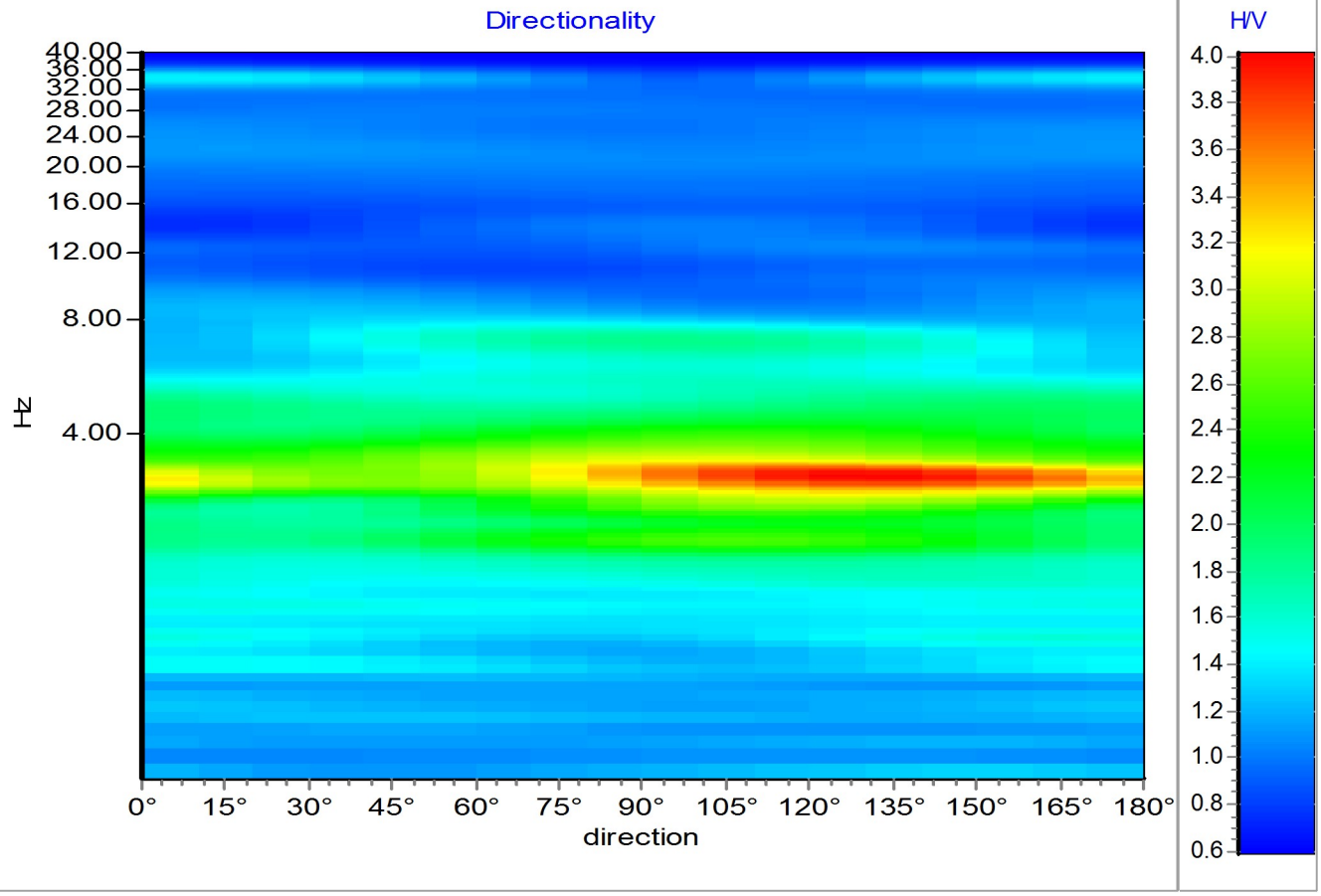
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **24 Levane**





Misura 25 HVRS

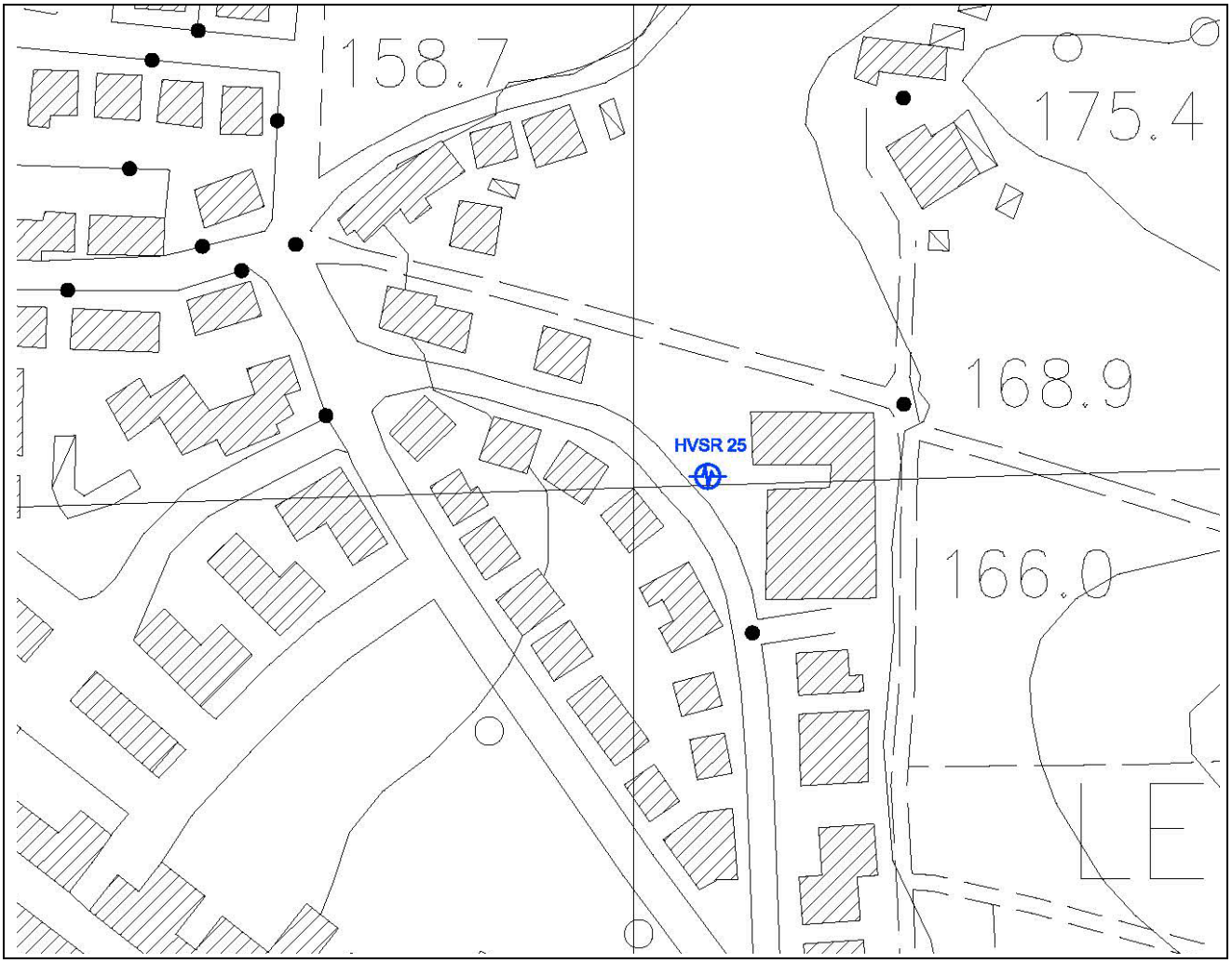


Figura 25.1 – individuazione del sito di studio - scala 1:2.000

Figura 25.2: rilievo sismico

H/V Spectral ratio

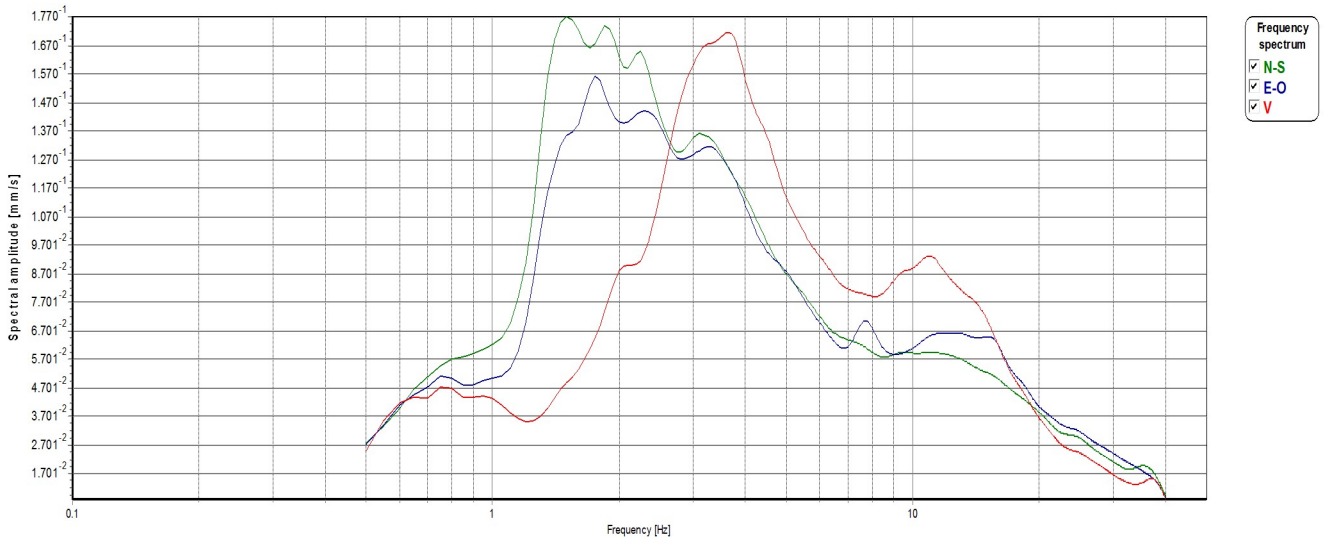
Analysis site: **Montevarchi**

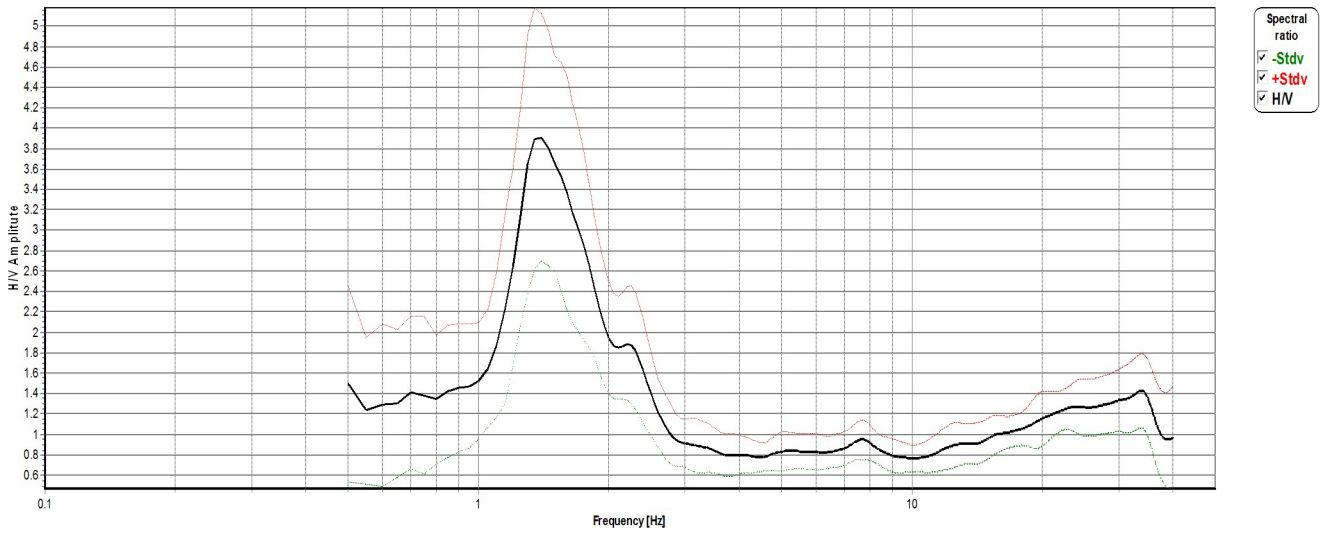
Measure point: **25 Levane**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 15:06:17**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 15:41:17**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**87**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**18**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.410**	Standard deviation [Hz]:	**0.130**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **25 Levane**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.41 >= 0.50**	**Yes**
Nc(fø) > 200	**2453.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 42**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.000**	**Yes**
Aø > 2	**3.91 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**4.24% < 5.00%**	**Yes**
sf < e(fø)	**0.1304 < 0.1410**	**Yes**
sA(fø) < ?(fø)	**1.2172 < 1.7800**	**Yes**

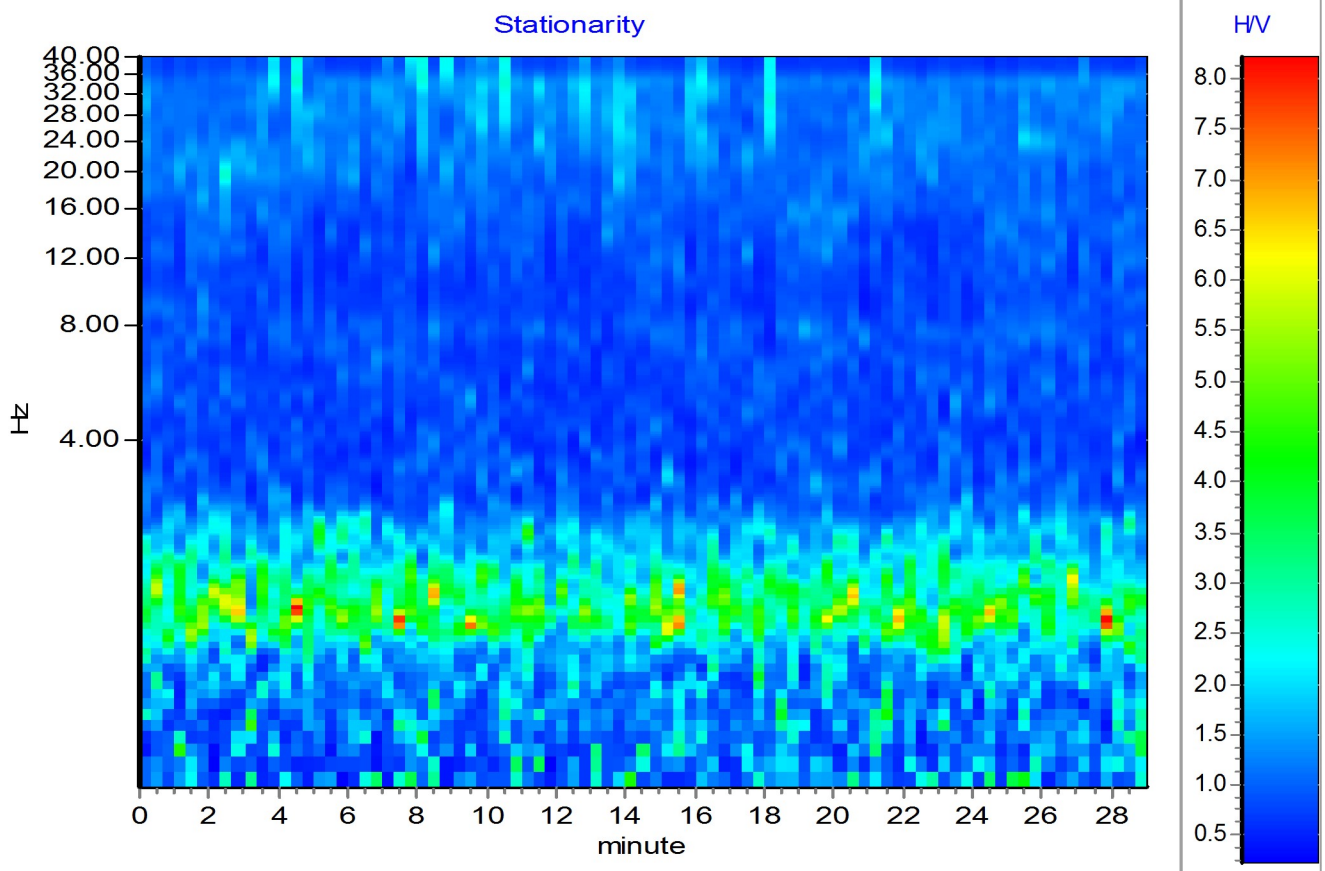
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

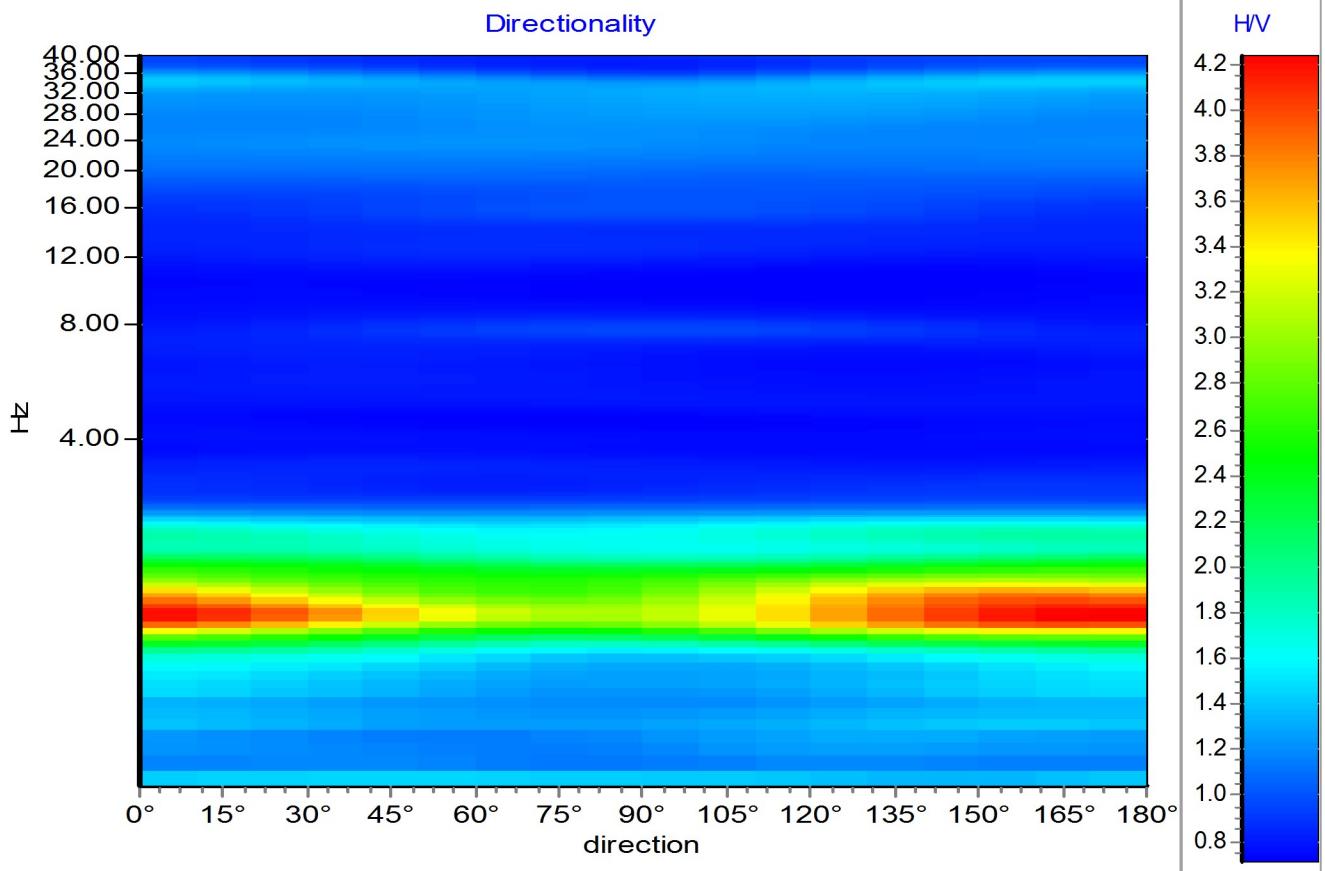
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **25 Levane**





Misura 26 HVRS

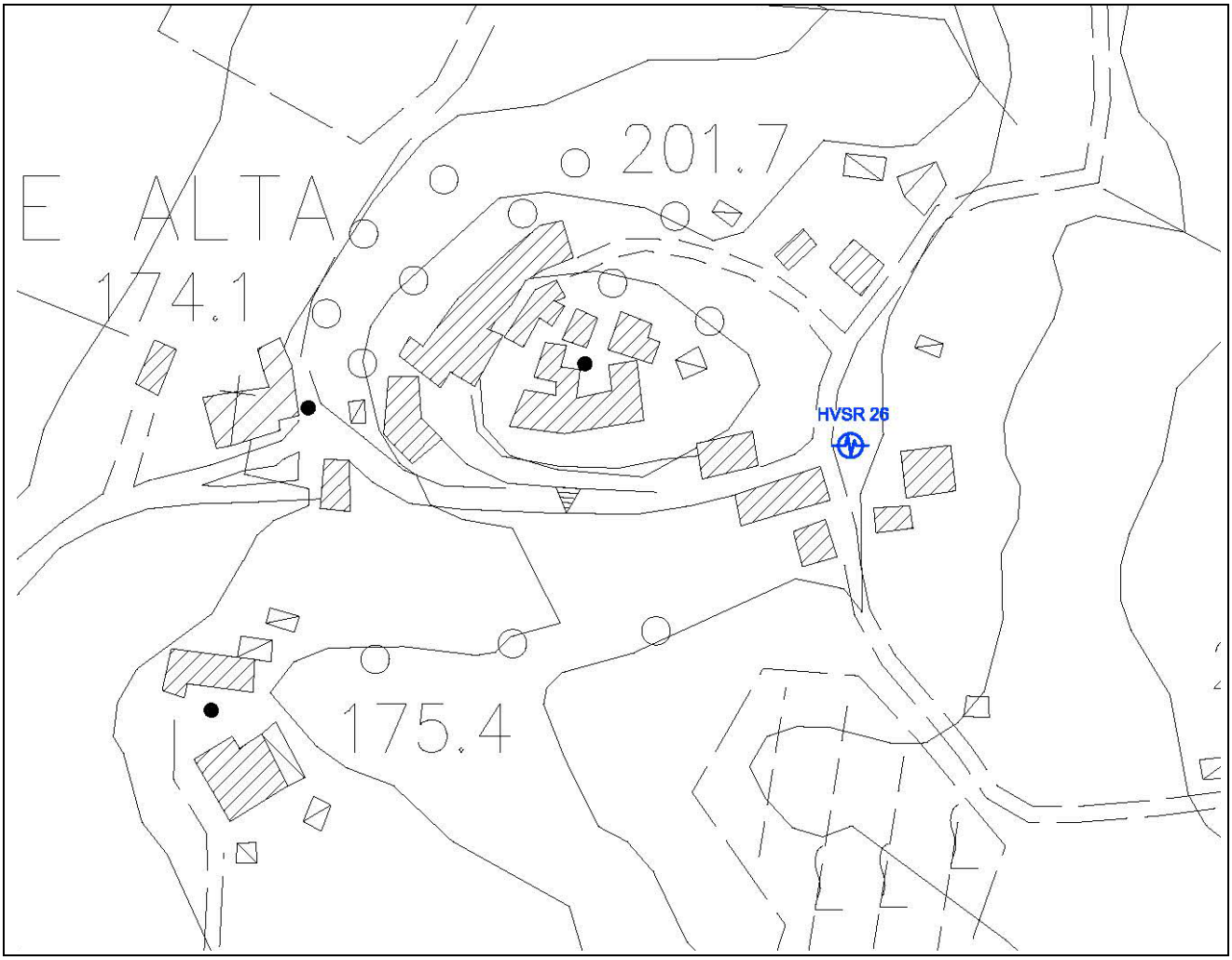


Figura 26.1 – individuazione del sito di studio - scala 1:2.000

Figura 26.2: rilievo sismico

H/V Spectral ratio

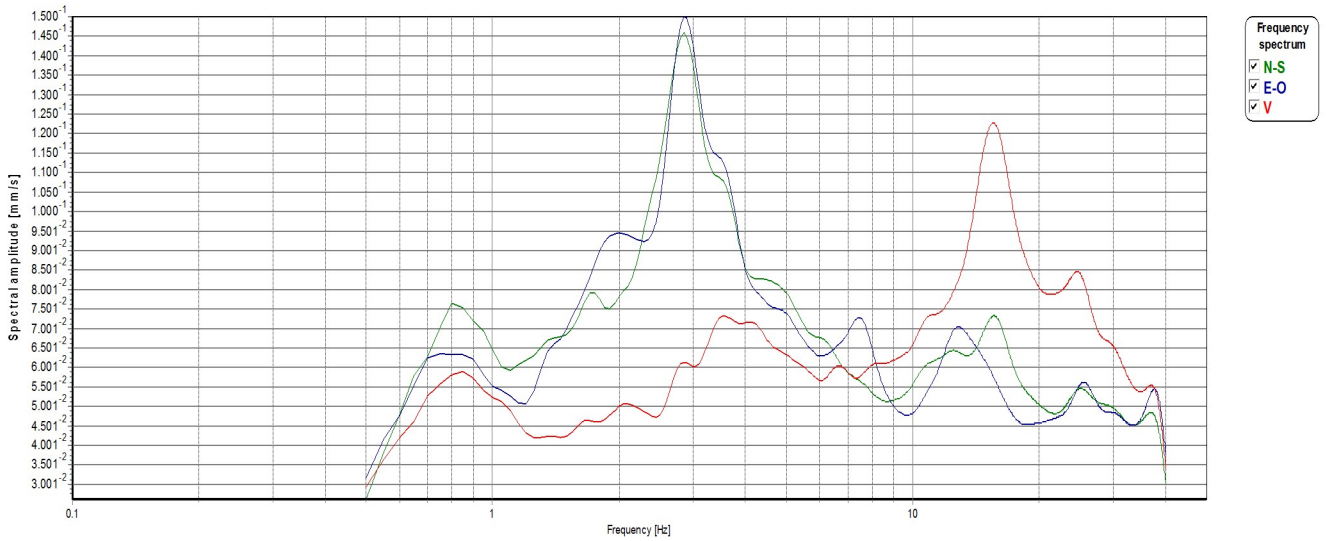
Analysis site: **Montevarchi**

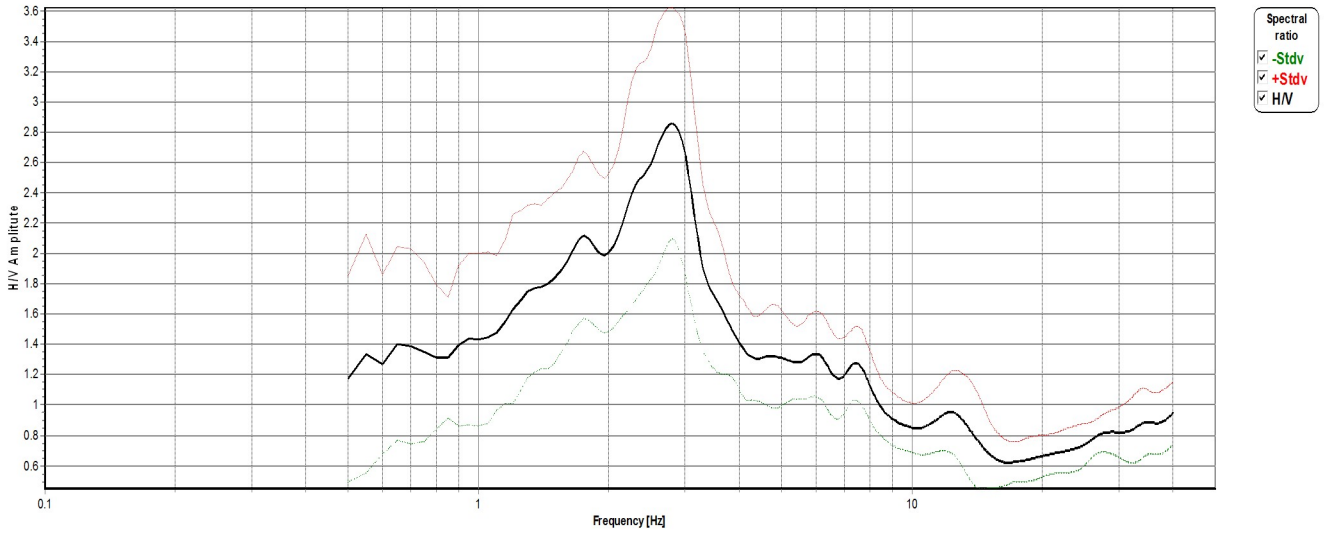
Measure point: **26 Levane**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 15:52:49**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 16:27:49**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**57**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**48**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**2.647**	Standard deviation [Hz]:	**0.257**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **26 Levane**

Criteria for a reliable H/V curve		
fø > 10/Lw	**2.65 >= 0.50**	**Yes**
Nc(fø) > 200	**3018.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 79**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.750**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**4.050**	**Yes**
Aø > 2	**2.77 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**5.77% > 5.00%**	**No**
sf < e(fø)	**0.2567 > 0.1324**	**No**
sA(fø) < ?(fø)	**0.7974 < 1.5800**	**Yes**

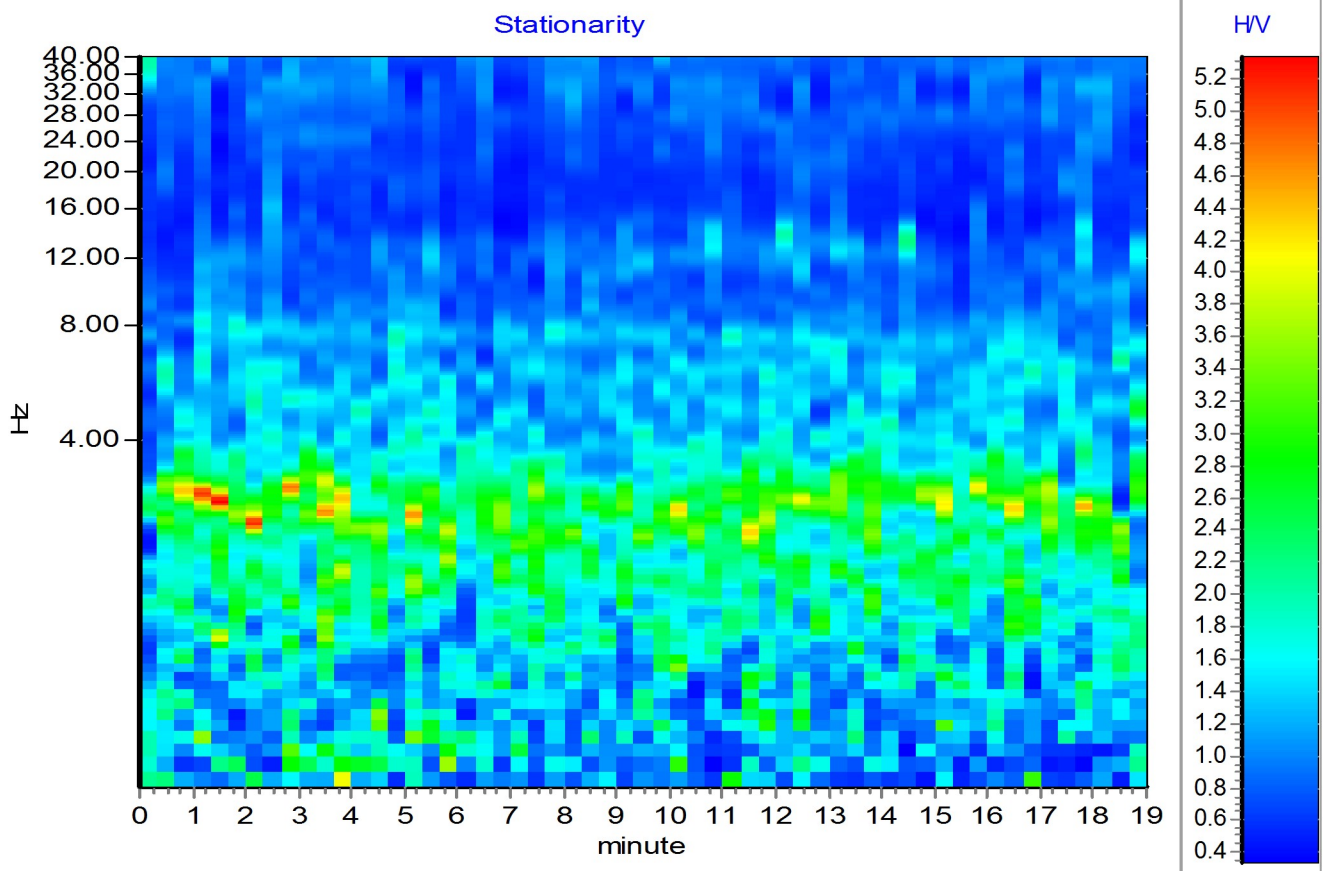
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

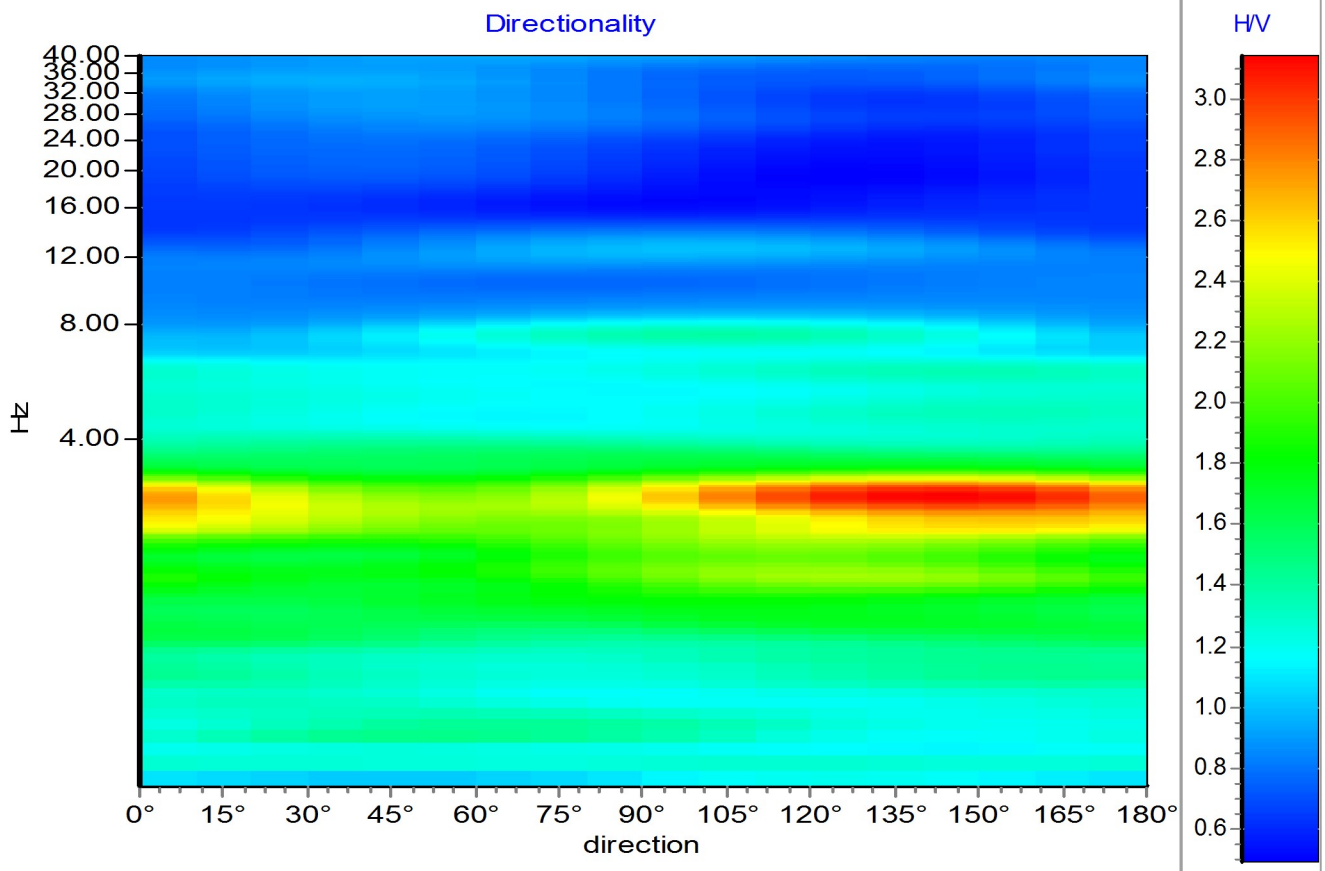
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **26 Levane**





Misura 27 HVRS

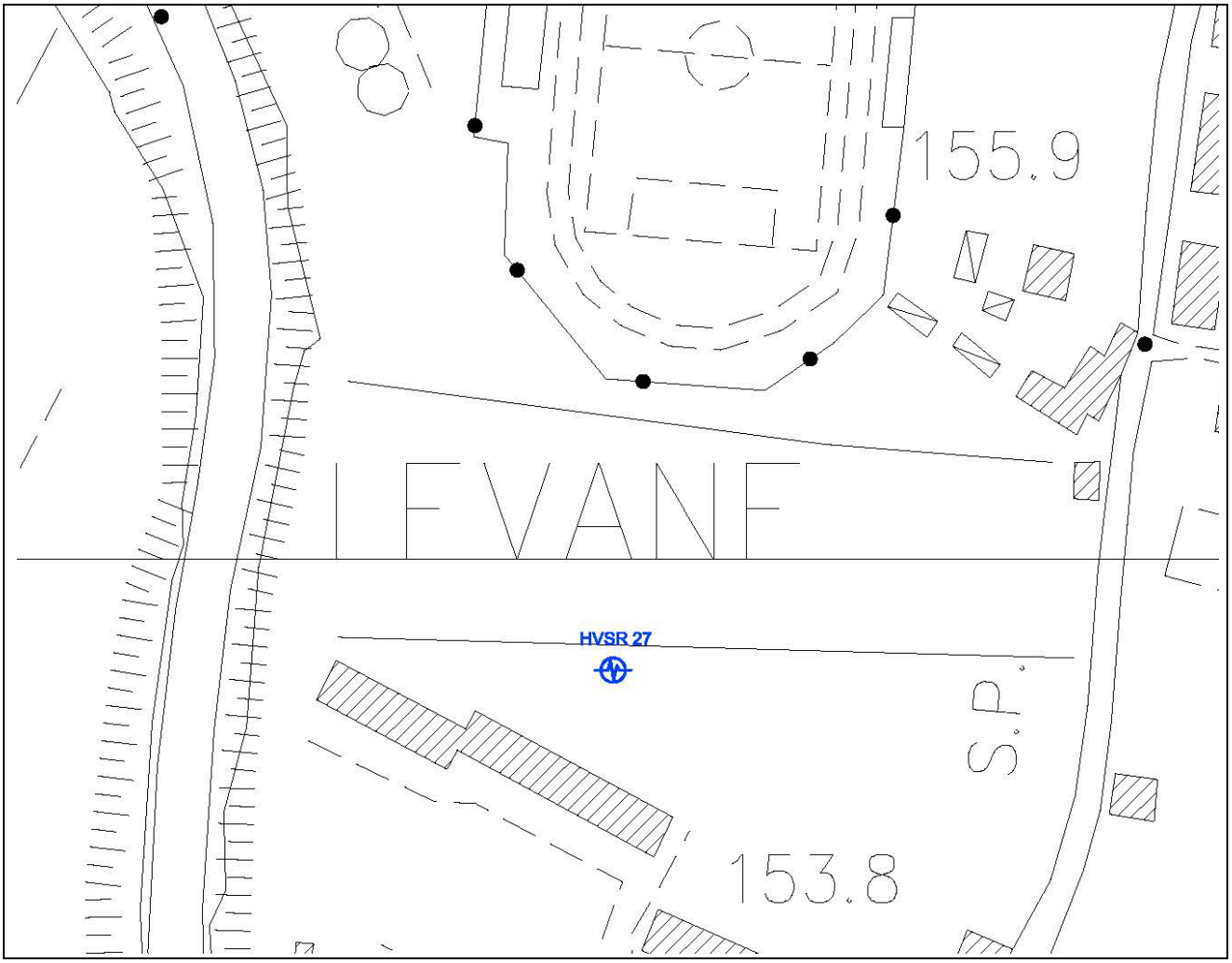


Figura 27.1 – individuazione del sito di studio - scala 1:2.000

Figura 27.2: rilievo sismico

H/V Spectral ratio

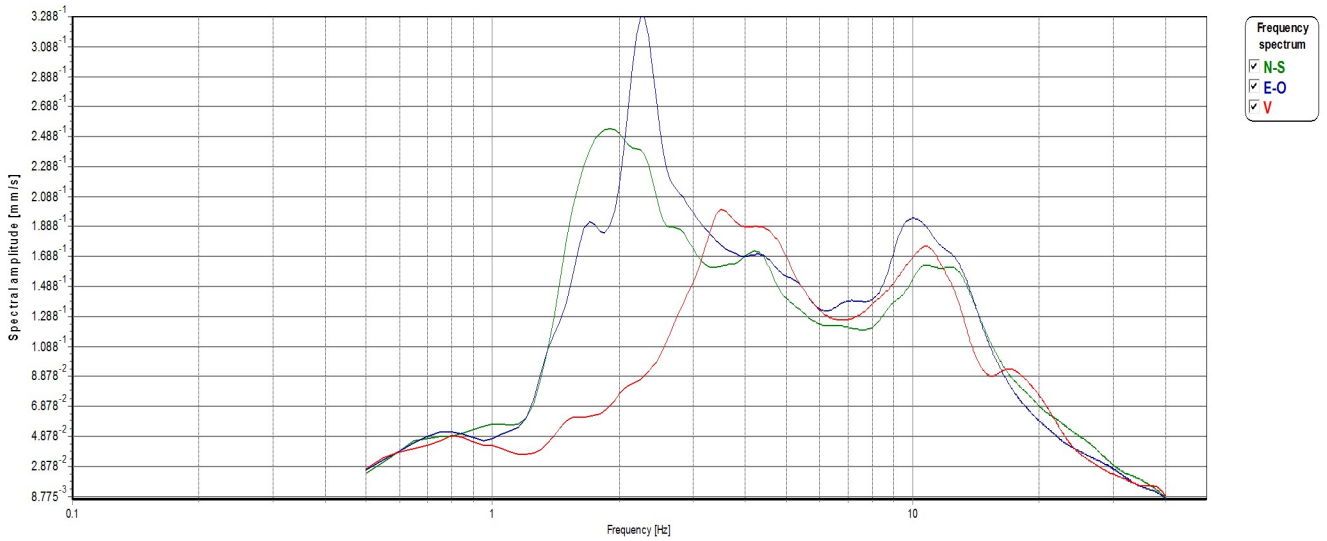
Analysis site: **Montevarchi**

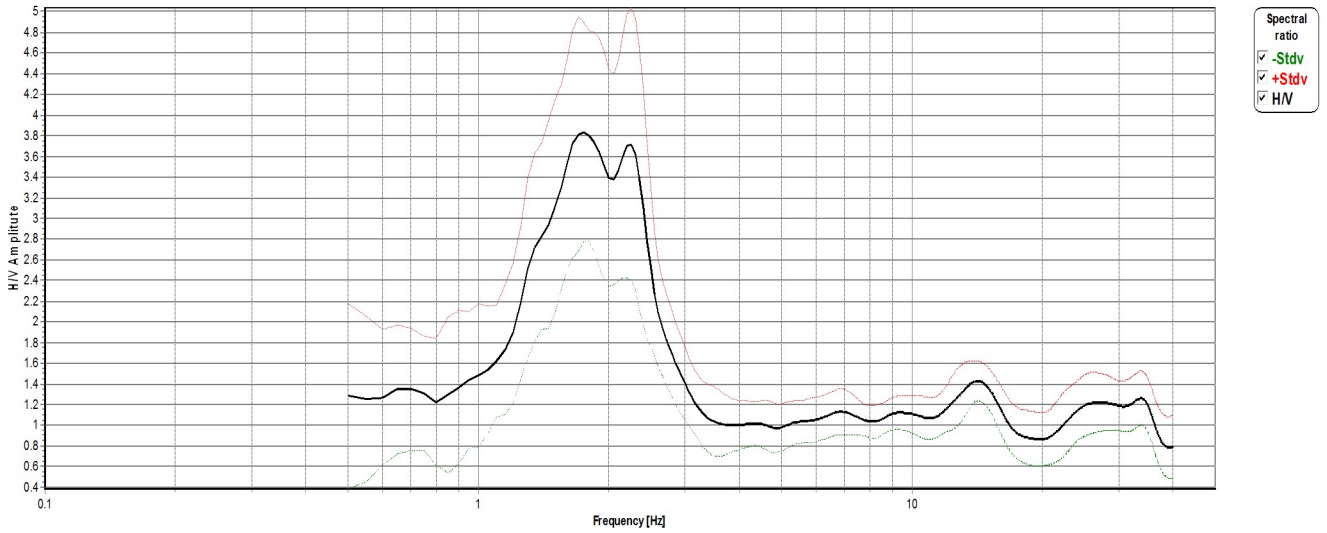
Measure point: **27 Levane**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 16:37:33**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 17:12:33**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**86**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**19**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.851**	Standard deviation [Hz]:	**0.289**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **27 Levane**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.85 >= 0.50**	**Yes**
Nc(fø) > 200	**3183.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 56**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.700**	**Yes**
Aø > 2	**3.74 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**21.58% > 5.00%**	**No**
sf < e(fø)	**0.2886 > 0.1851**	**No**
sA(fø) < ?(fø)	**1.0575 < 1.7800**	**Yes**

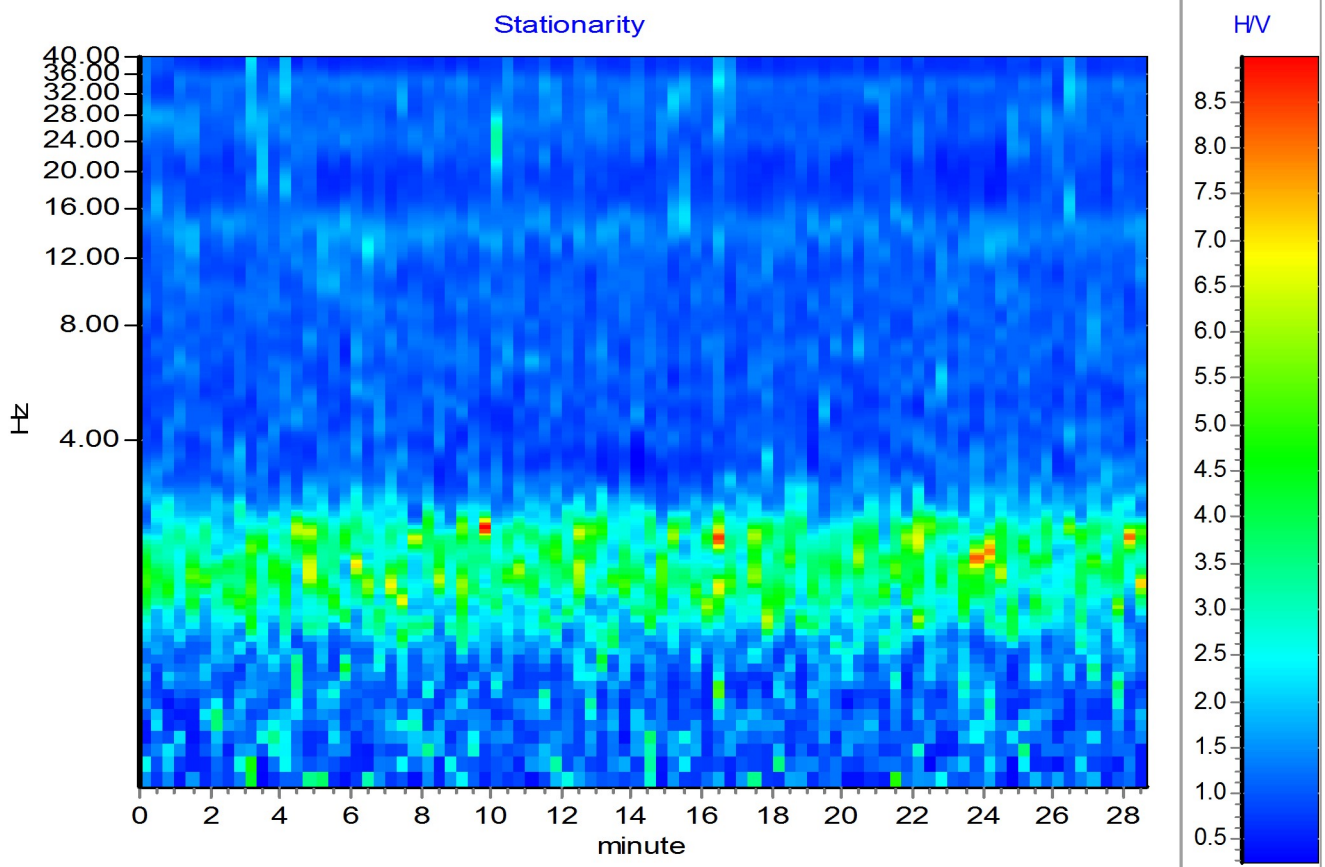
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

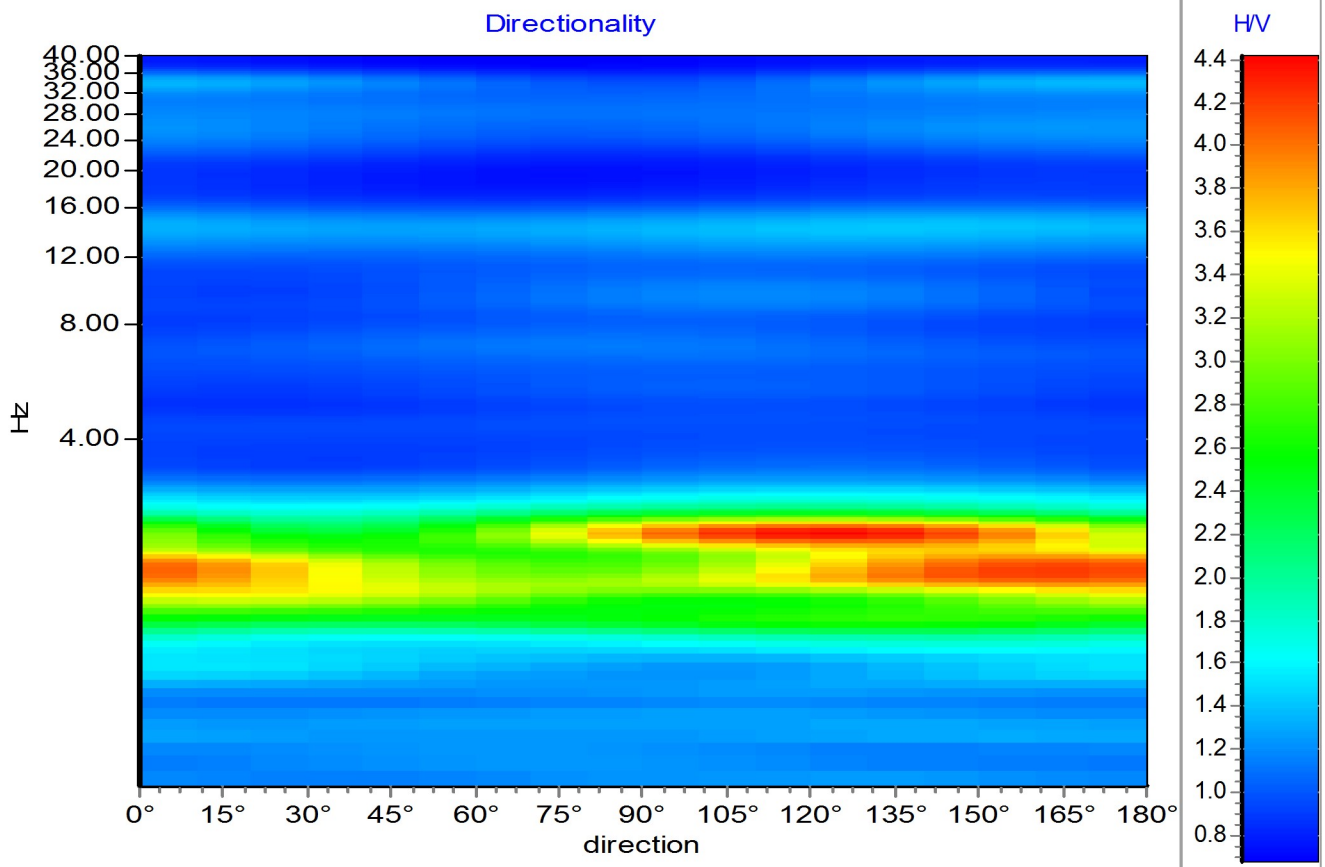
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **27 Levane**





Misura 28 HVRS

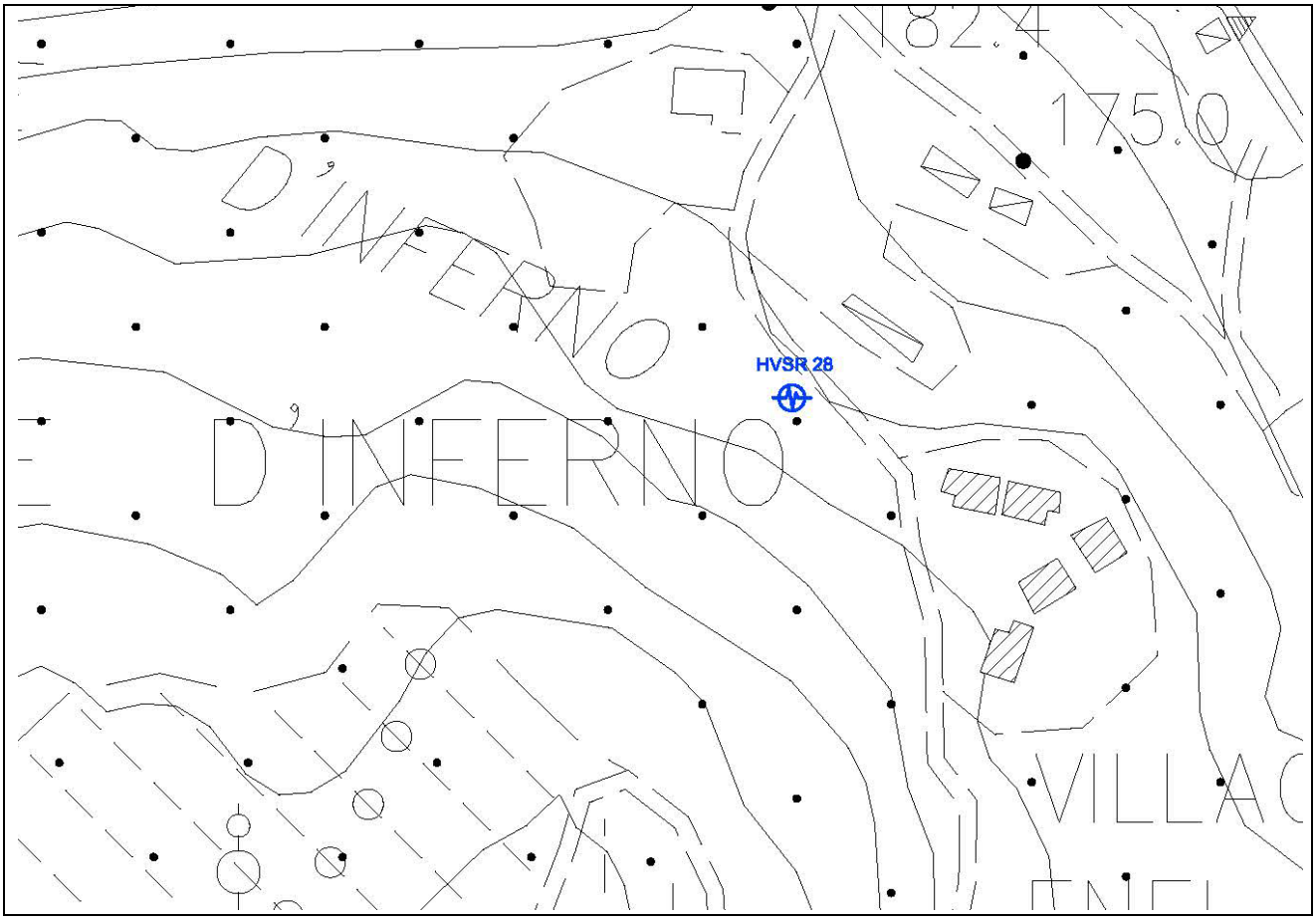


Figura 28.1 – individuazione del sito di studio - scala 1:2.000

Figura 28.2: rilievo sismico

H/V Spectral ratio

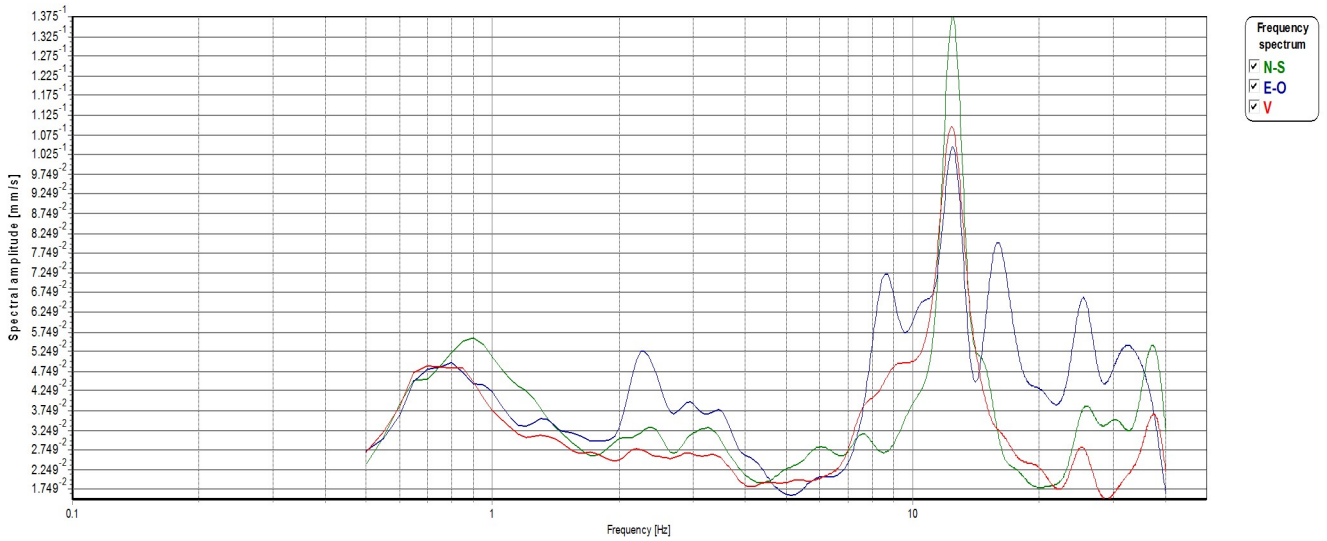
Analysis site: **Montevarchi**

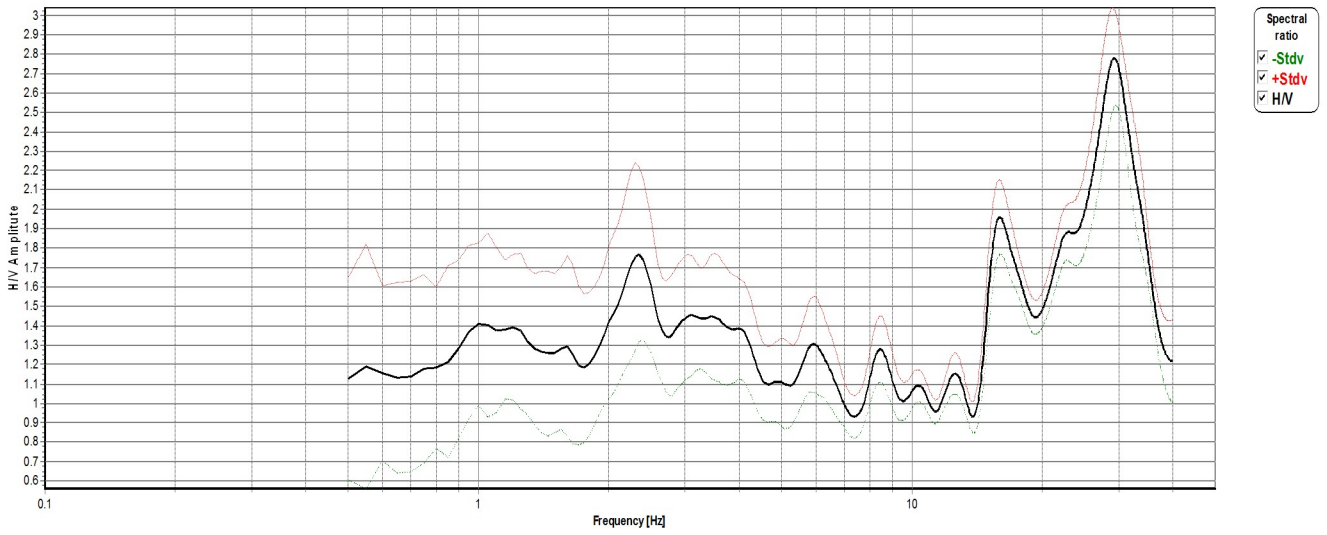
Measure point: **28 Valle d'Inferno**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 17:26:03**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 18:01:03**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**46**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**59**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**29.388**	Standard deviation [Hz]:	**0.771**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **28 Valle d'Inferno**

Criteria for a reliable H/V curve		
fø > 10/Lw	**29.39 >= 0.50**	**Yes**
Nc(fø) > 200	**27037.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 507**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**7.350**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**37.050**	**Yes**
Aø > 2	**2.78 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**1.32% < 5.00%**	**Yes**
sf < e(fø)	**0.7712 < 1.4694**	**Yes**
sA(fø) < ?(fø)	**0.2448 < 1.5800**	**Yes**

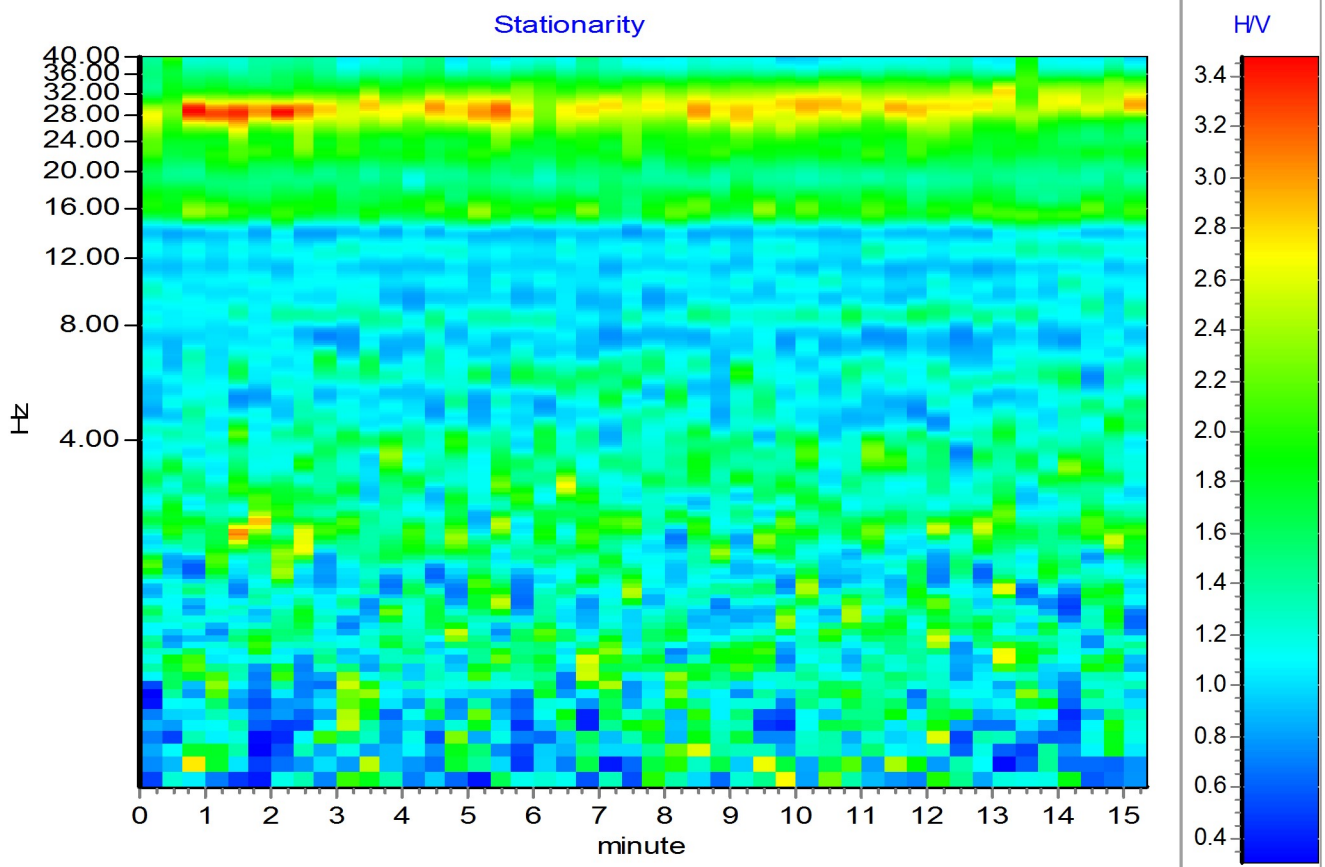
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

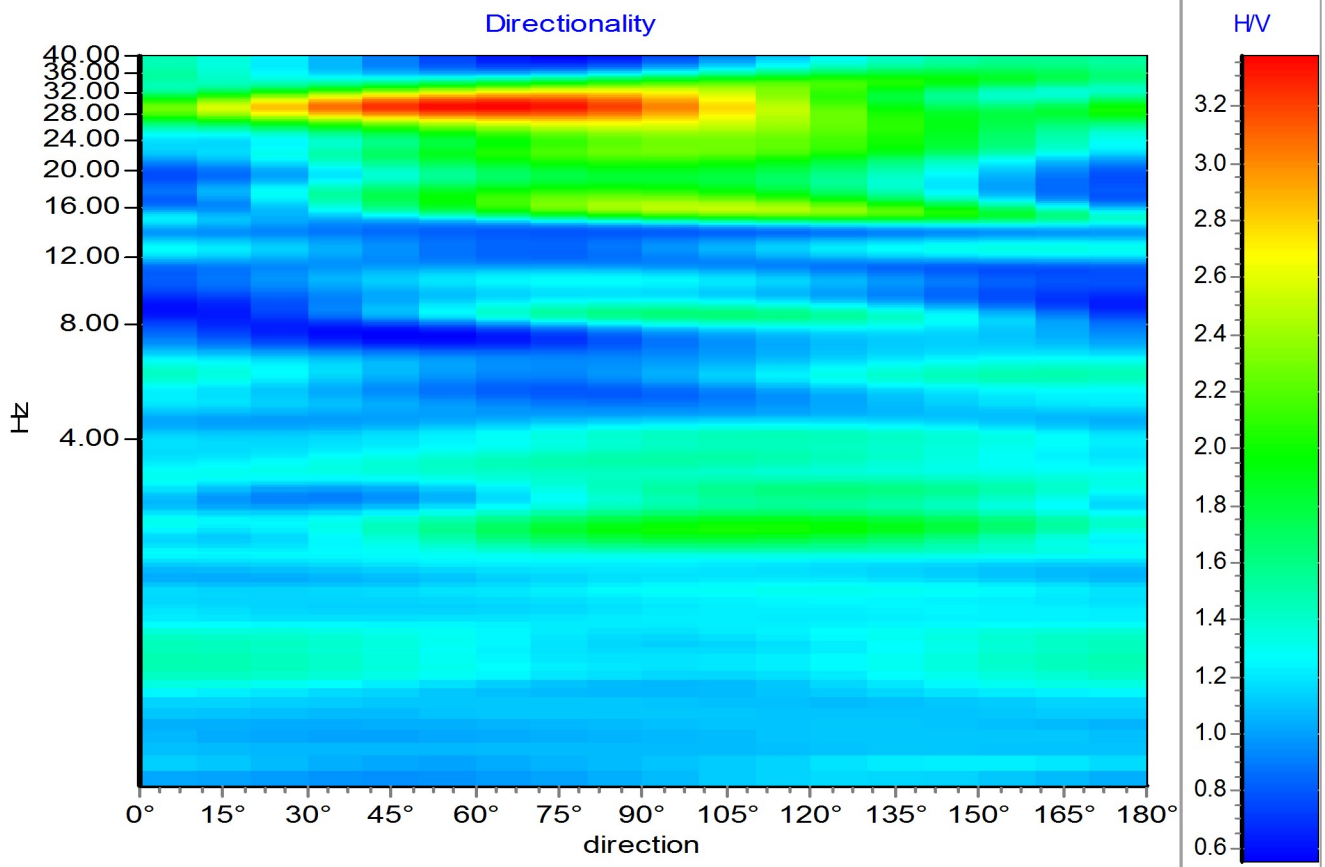
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **28 Valle d'Inferno**





Misura 29 HVRS

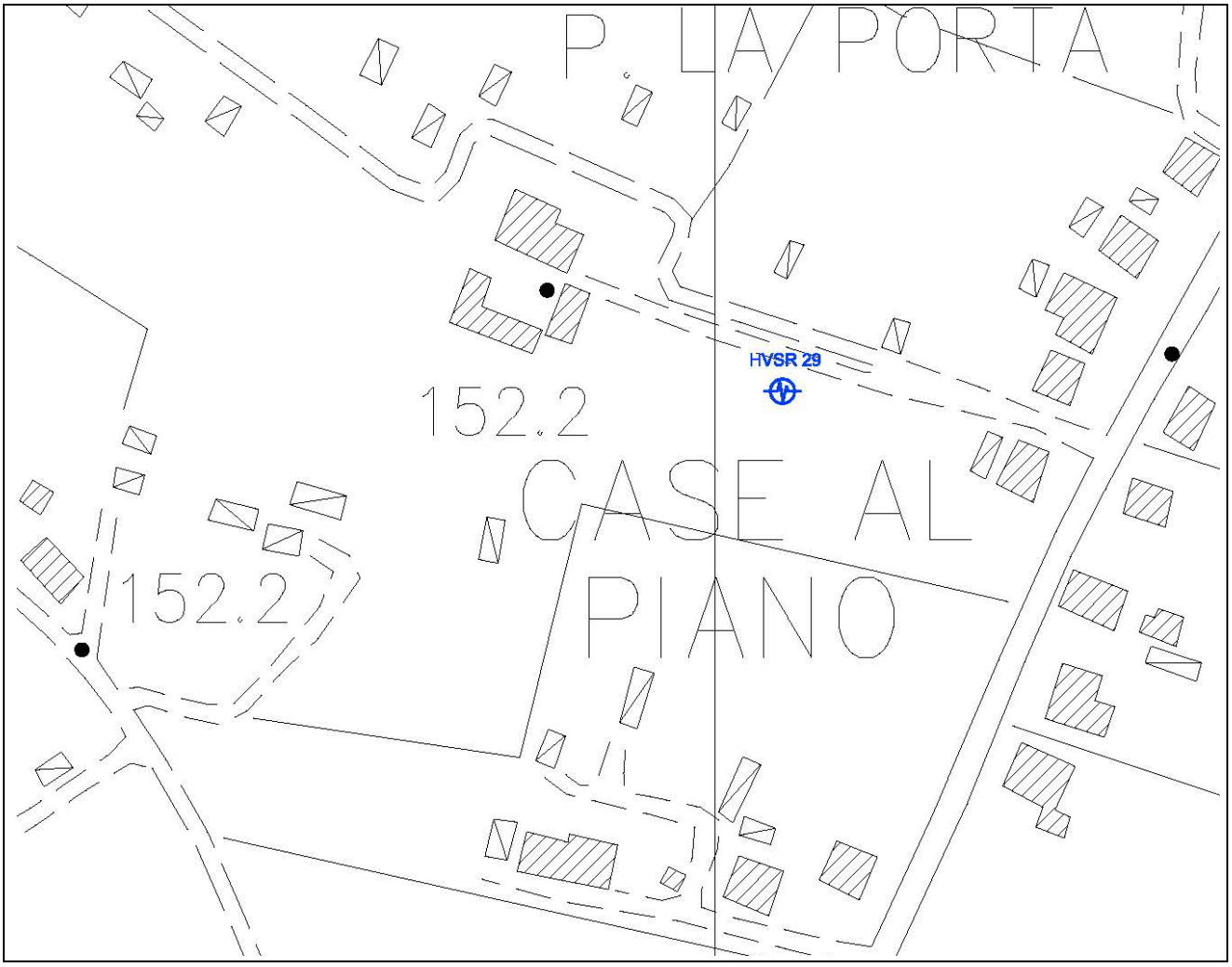


Figura 29.1 – individuazione del sito di studio - scala 1:2.000

Figura 29.2: rilievo sismico

H/V Spectral ratio

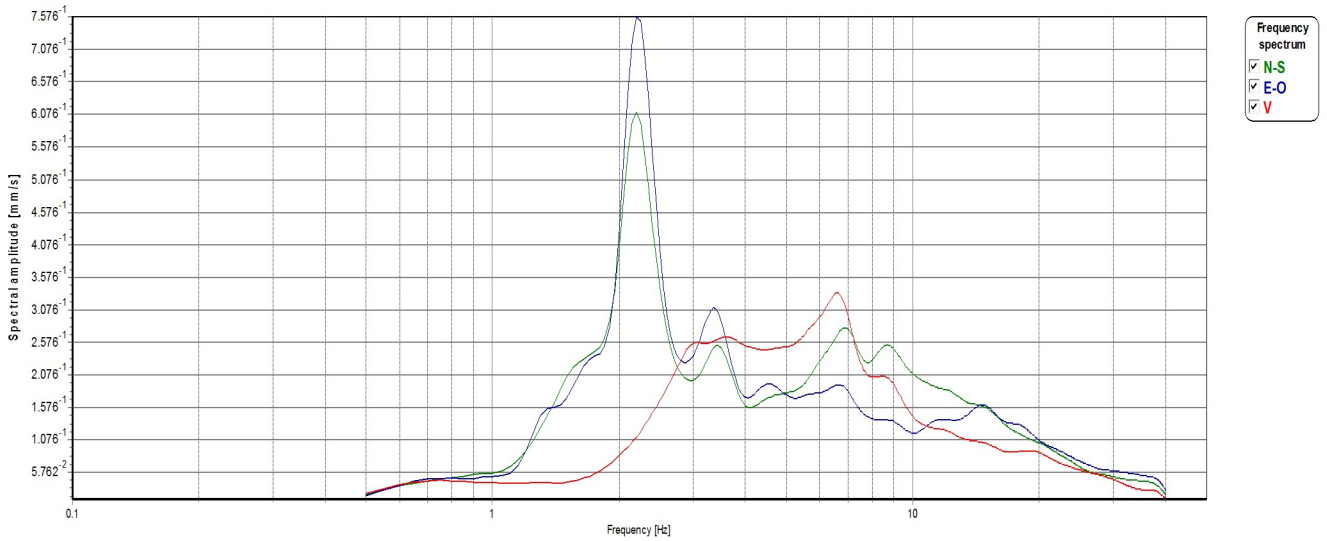
Analysis site: **Montevarchi**

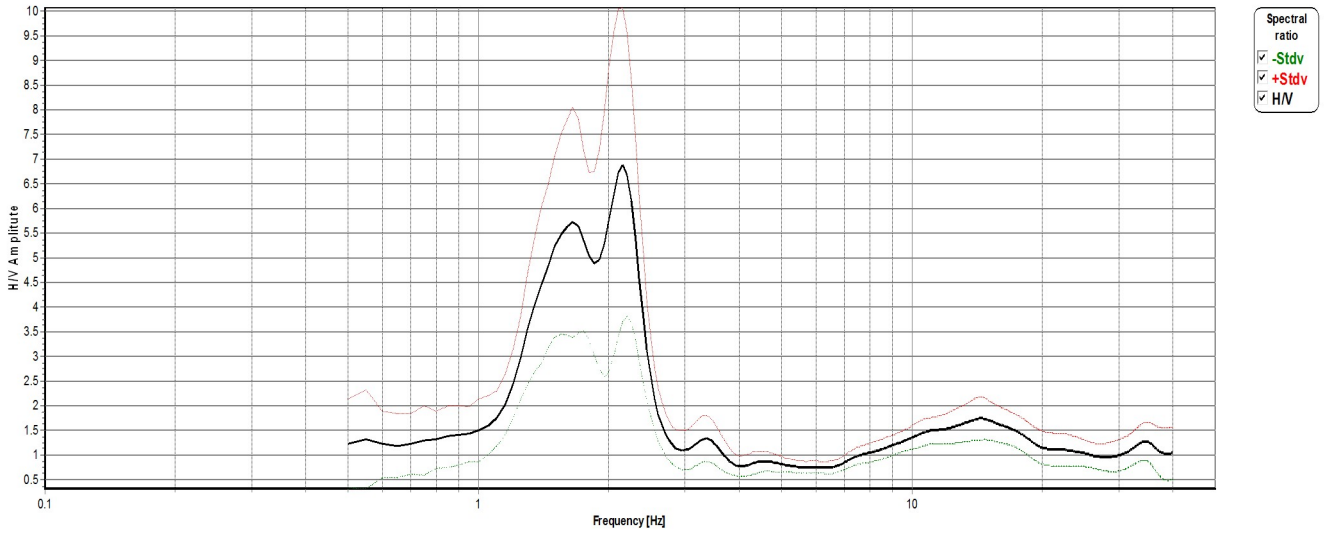
Measure point: **29 Case al Piano**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**24/02/2021 18:11:43**
Automatic spike removal:	**No**	Stop recordings:	**24/02/2021 18:46:43**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**40.00**
Ratio:	**1.9**	Nw number of windows:	**88**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**17**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**2.328**	Standard deviation [Hz]:	**4.048**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **29 Case al Piano**

Criteria for a reliable H/V curve		
fø > 10/Lw	**2.33 >= 0.50**	**Yes**
Nc(fø) > 200	**4098.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 13 out of 70**	**No**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.600**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.550**	**Yes**
Aø > 2	**4.57 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**7.66% > 5.00%**	**No**
sf < e(fø)	**4.0479 > 0.1164**	**No**
sA(fø) < ?(fø)	**1.6741 > 1.5800**	**No**

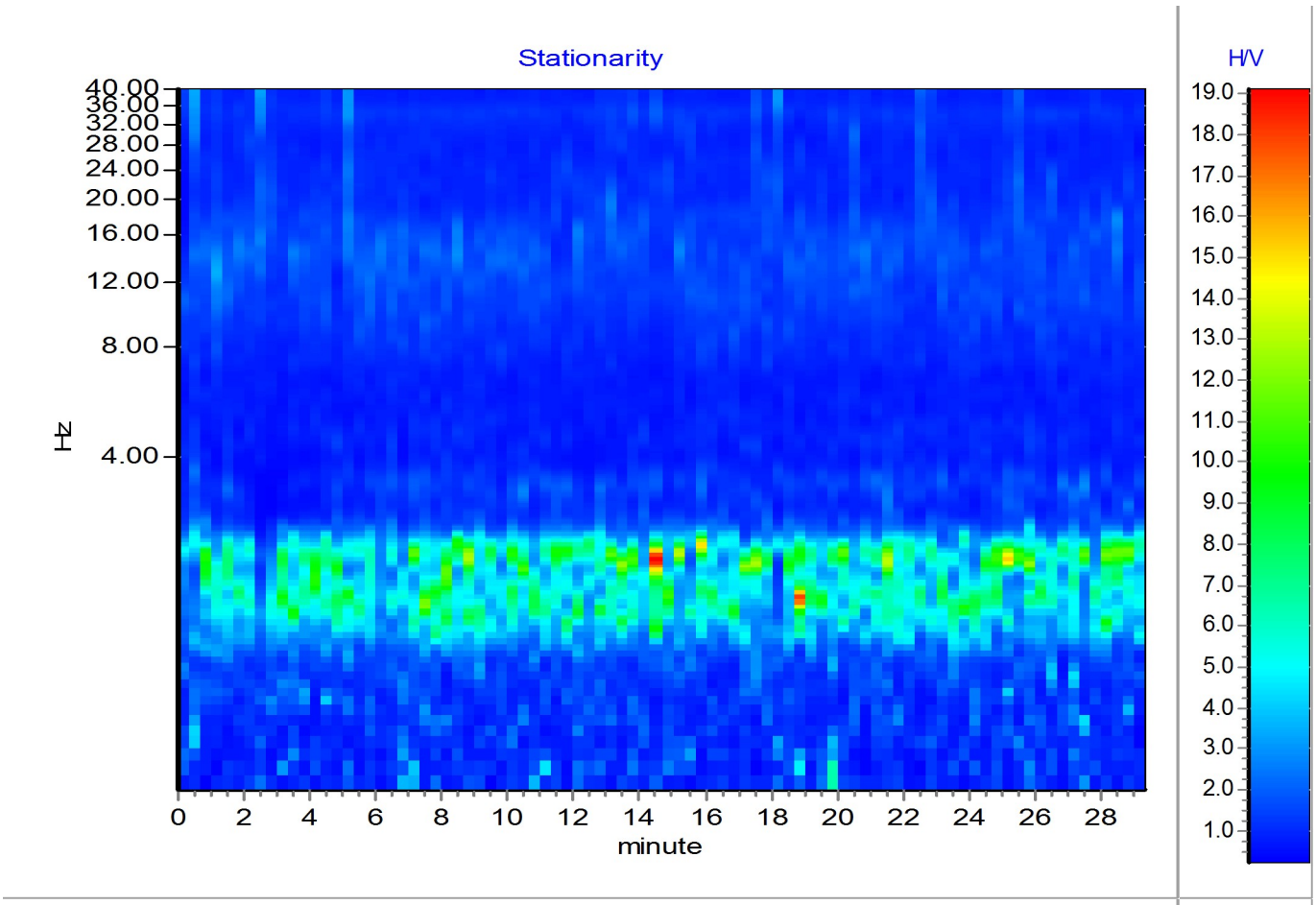
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

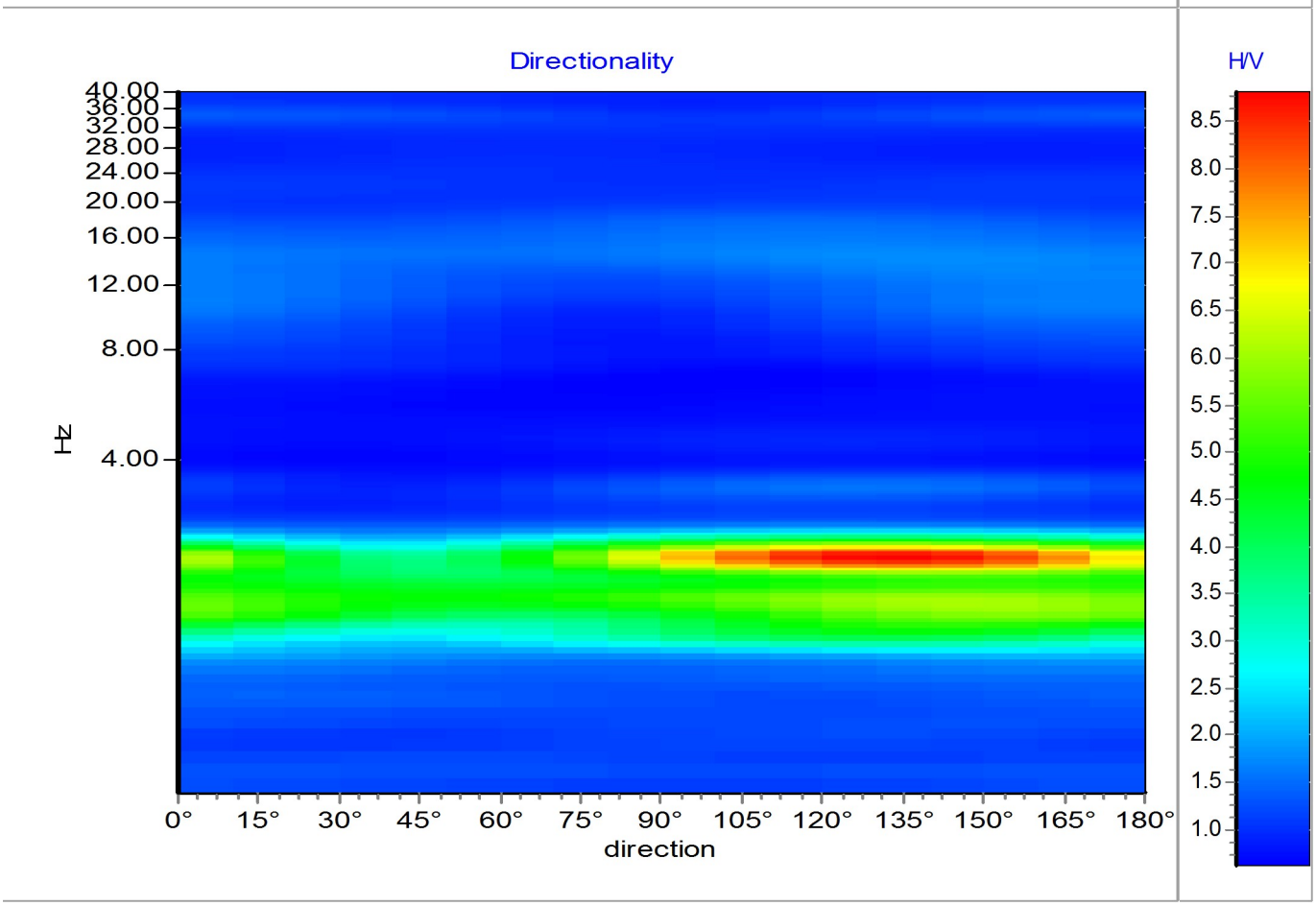
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **29 Case al Piano**





Misura 30 HVRS

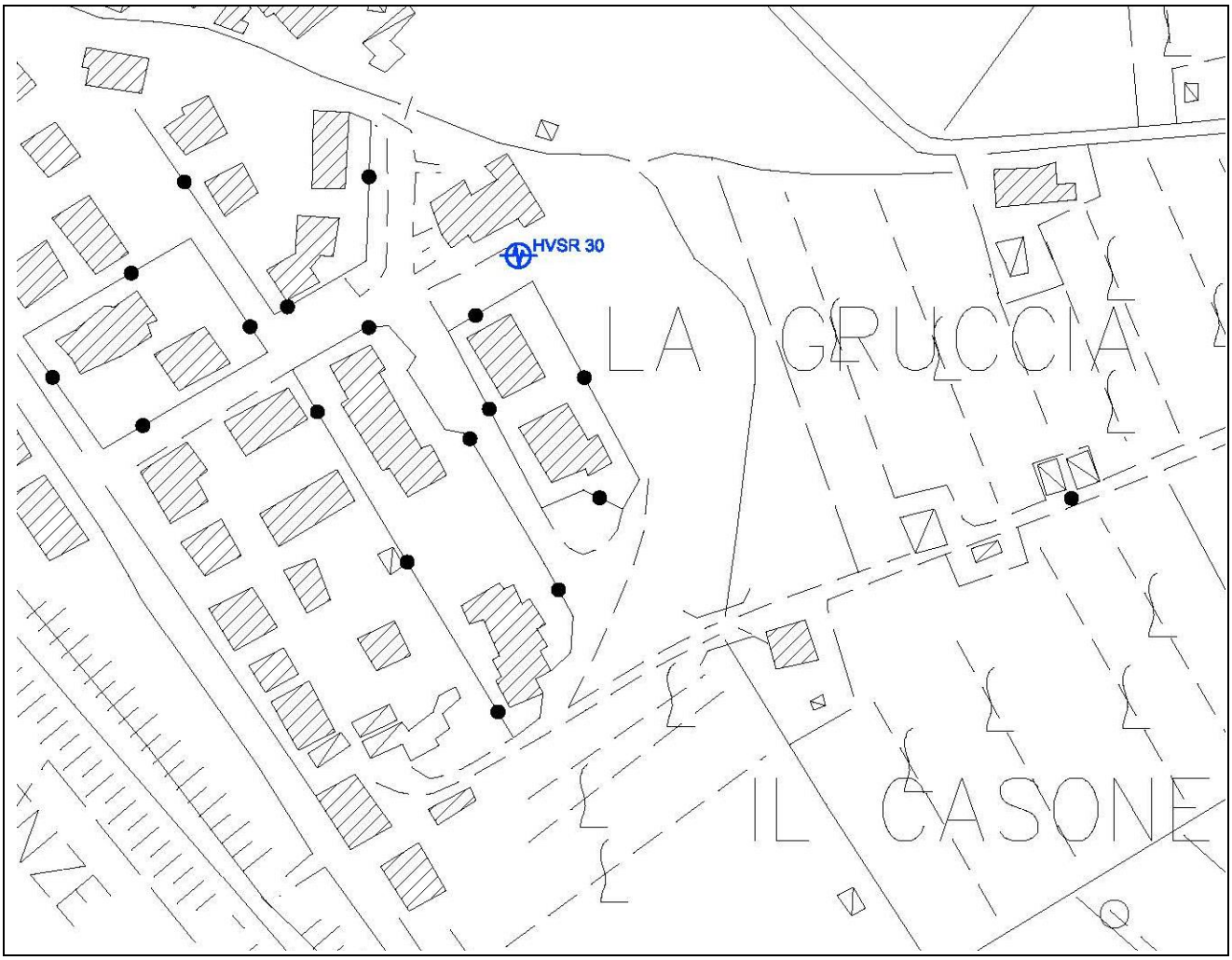


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

H/V Spectral ratio

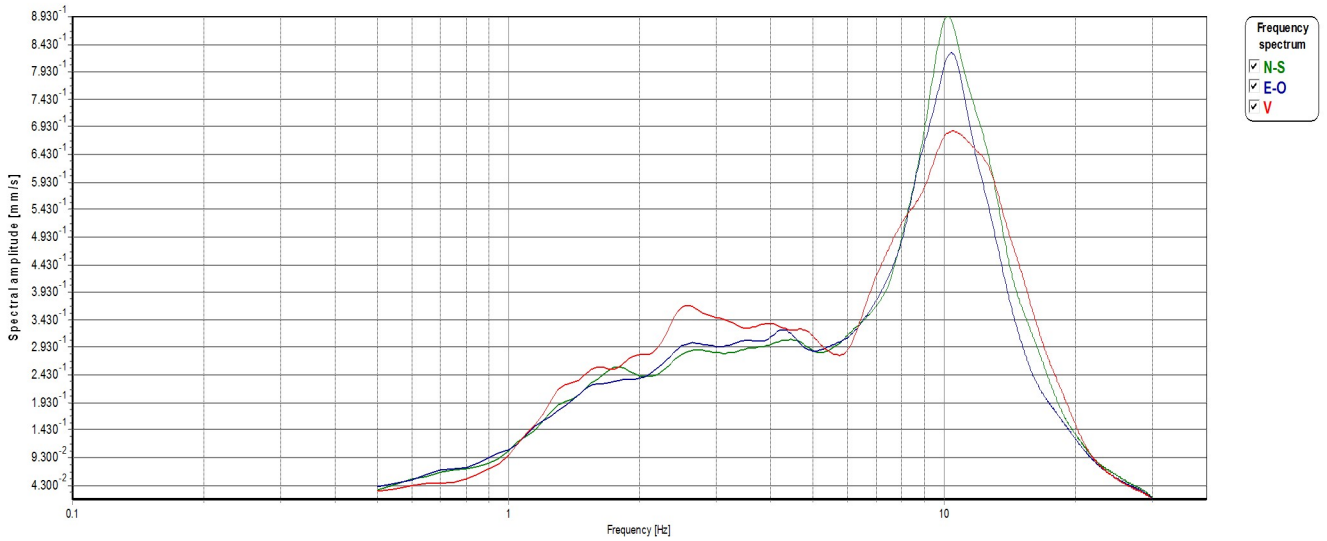
Analysis site: **Montevarchi**

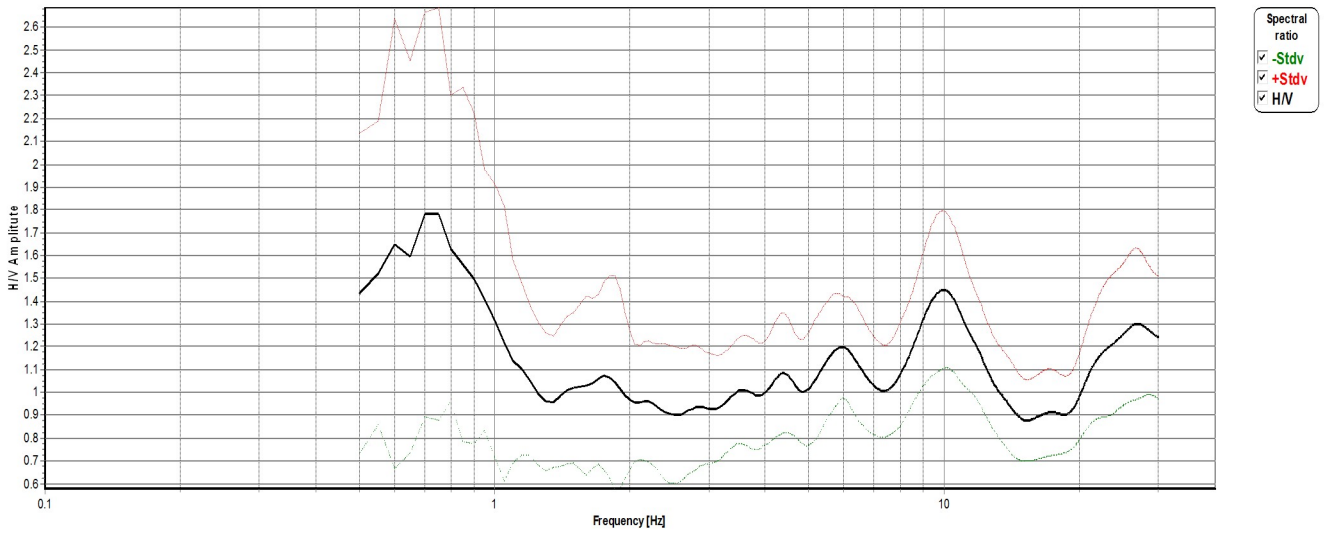
Measure point: **30 La Gruccia**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 12:16:30**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 12:51:30**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**78**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**27**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.840**	Standard deviation [Hz]:	**0.305**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **30 La Gruccia**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.84 >= 0.50**	**Yes**
Nc(fø) > 200	**1311.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 24**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.56 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**1101.80% > 5.00%**	**No**
sf < e(fø)	**0.3052 > 0.1261**	**No**
sA(fø) < ?(fø)	**0.7759 < 2.0000**	**Yes**

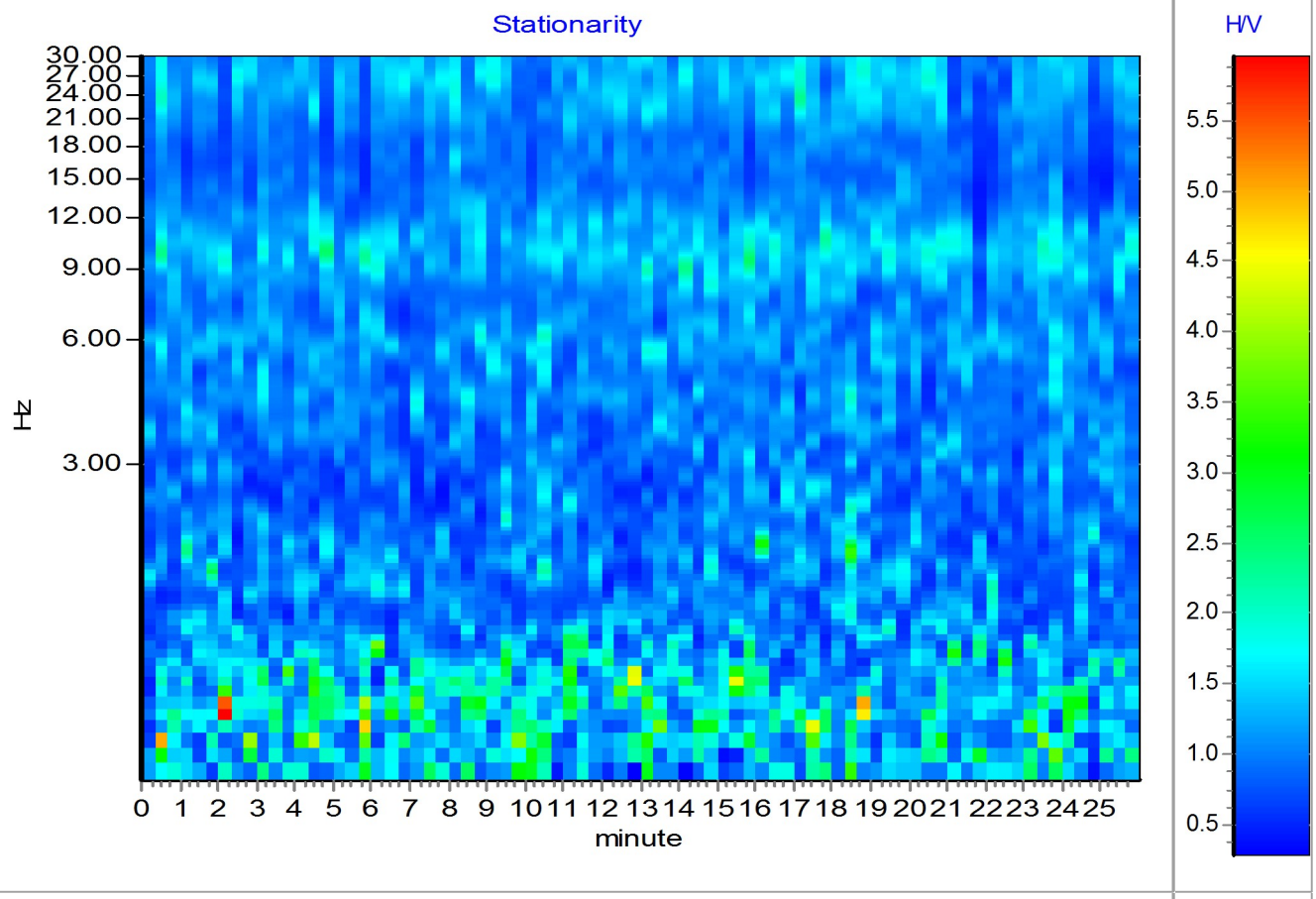
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

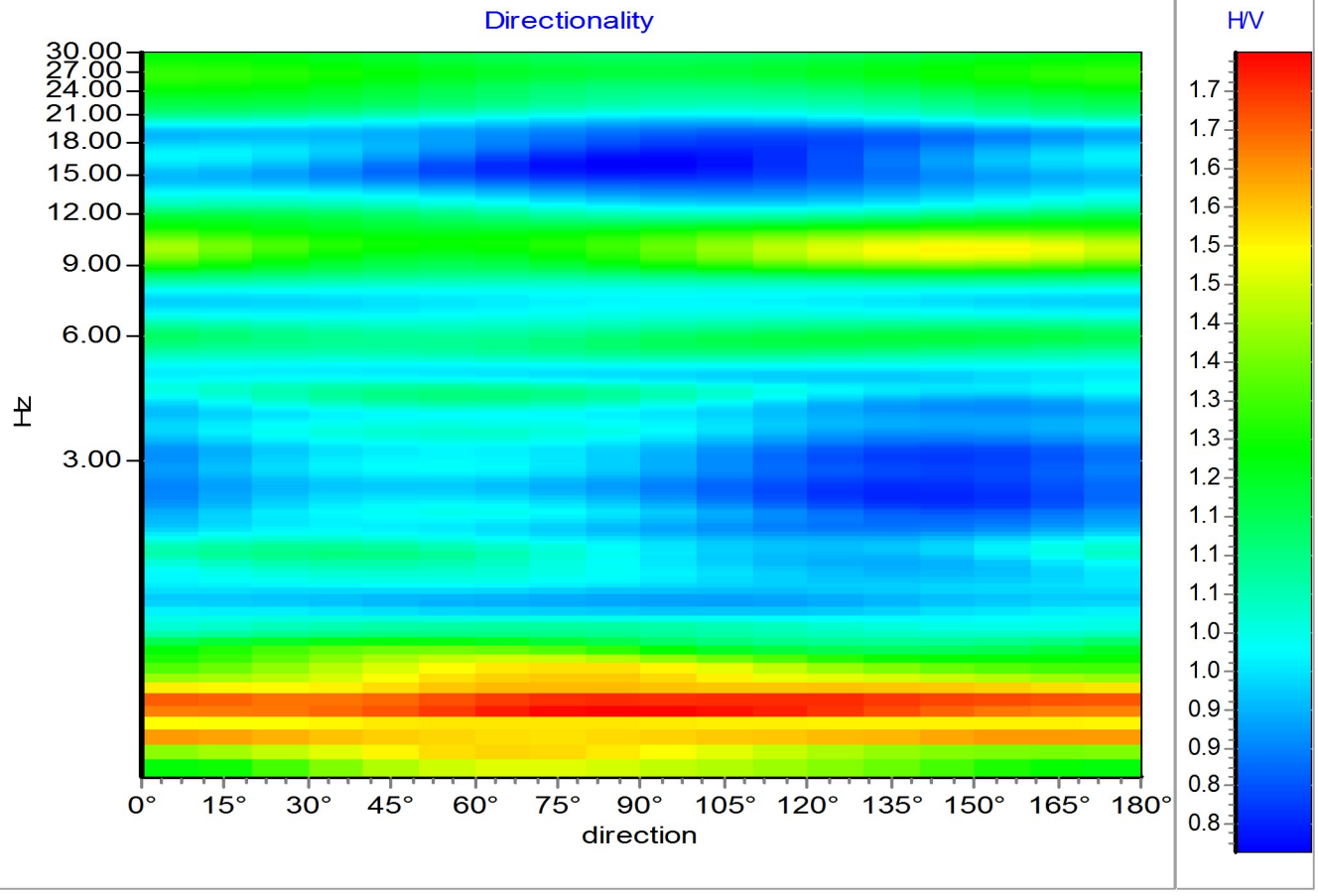
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **30 La Gruccia**





Misura 31 HVRS

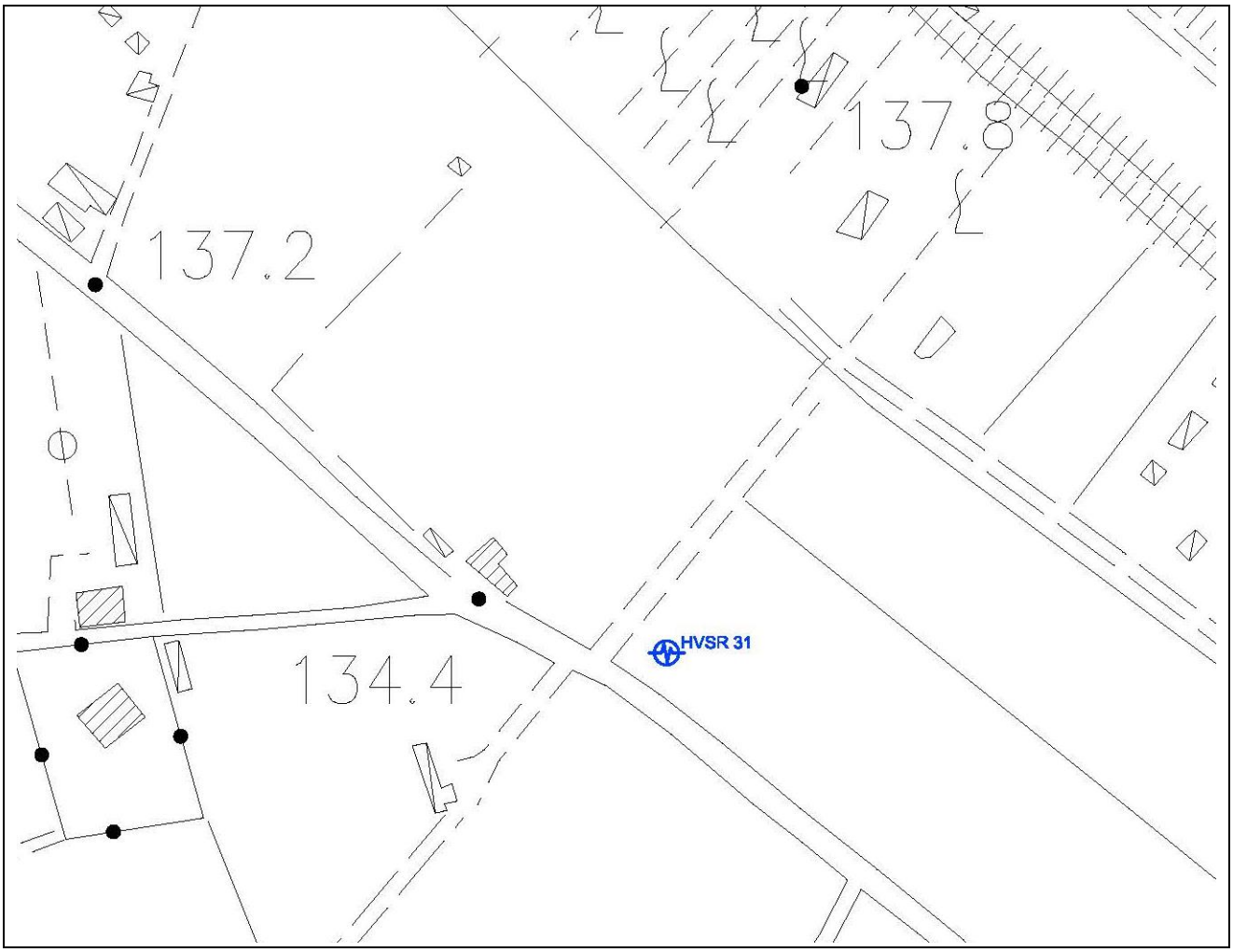


Figura 2.1 – individuazione del sito di studio – scala 1:2.000

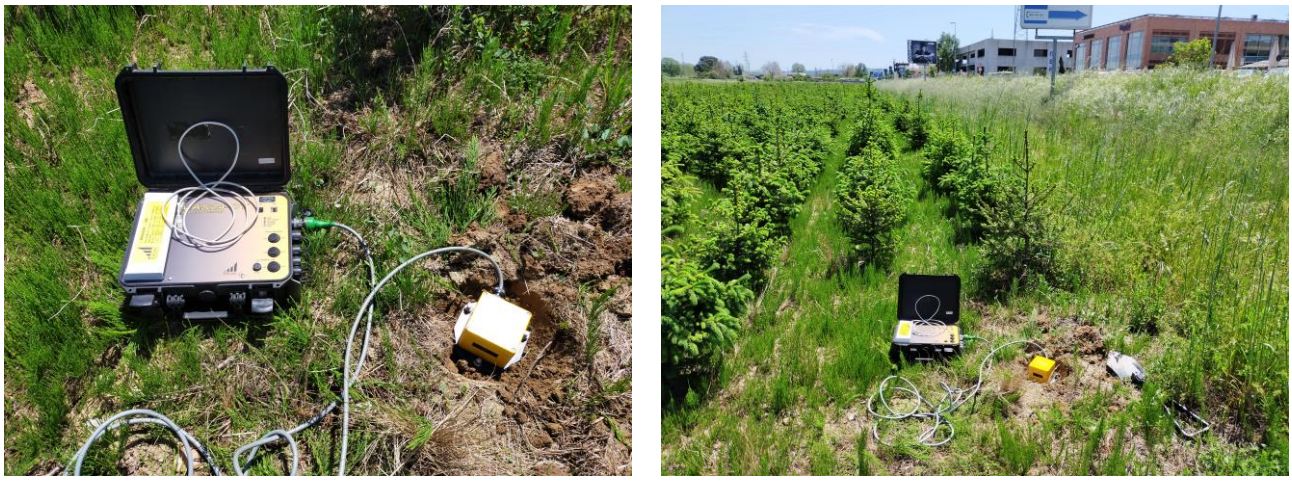


Figura 2.2: rilievo sismico

H/V Spectral ratio

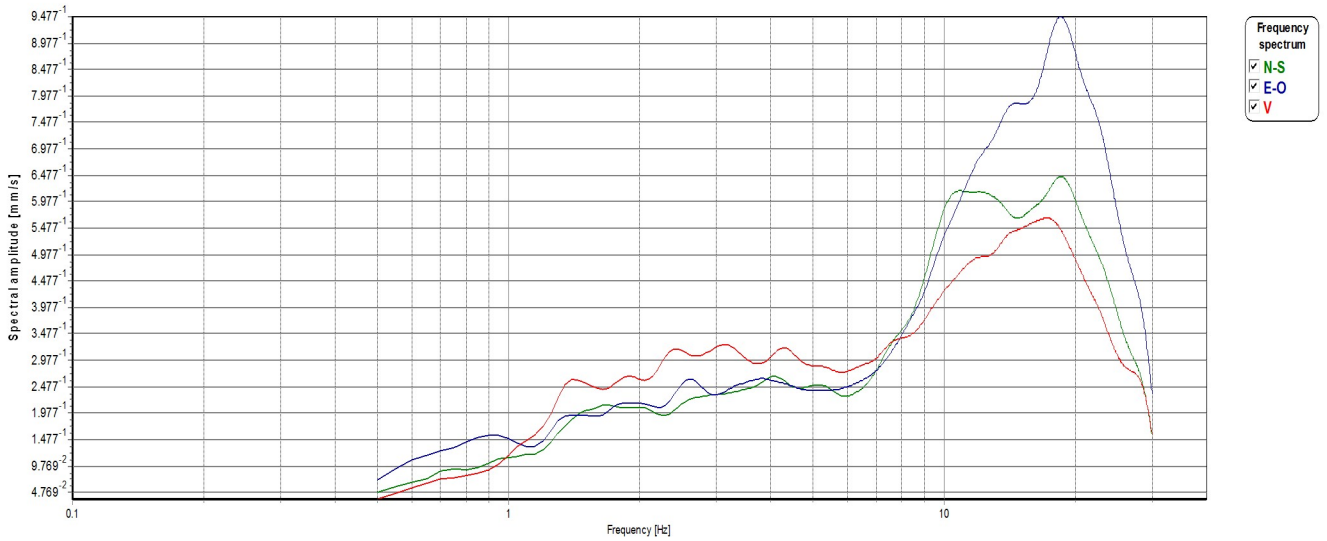
Analysis site: **Montevarchi**

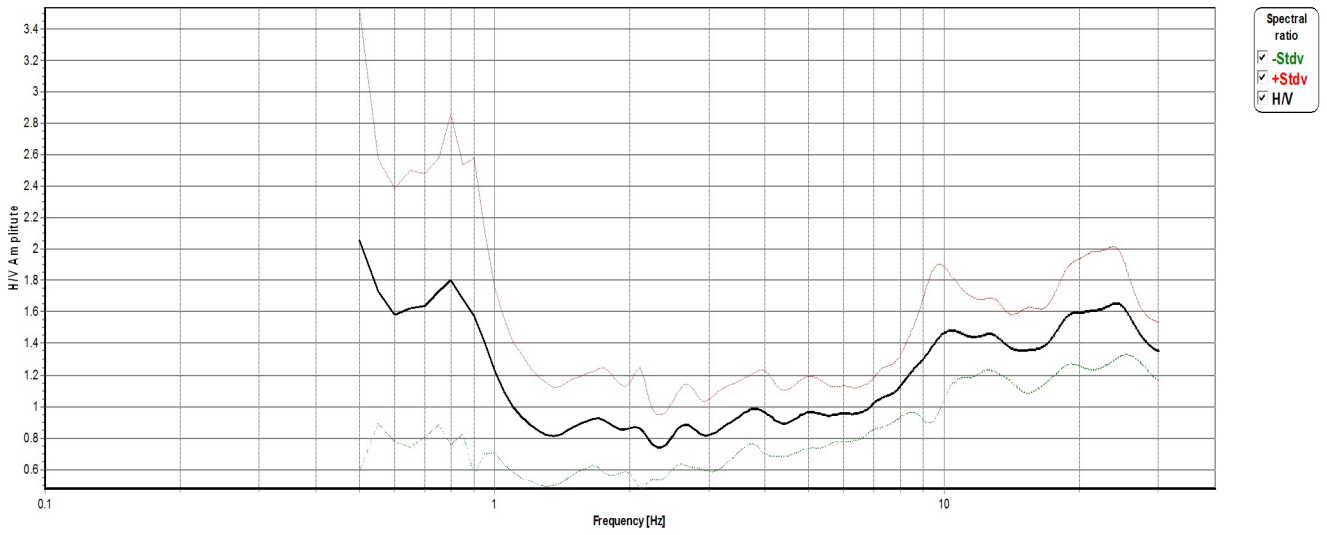
Measure point: **31 Abetaia**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 13:02:04**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 13:37:04**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**75**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**30**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.709**	Standard deviation [Hz]:	**0.302**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **31 Abetaia**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.71 >= 0.50**	**Yes**
Nc(fø) > 200	**1063.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 19**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.350**	**Yes**
Aø > 2	**1.64 < 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**3477.10% > 5.00%**	**No**
sf < e(fø)	**0.3018 > 0.1063**	**No**
sA(fø) < ?(fø)	**0.8376 < 2.0000**	**Yes**

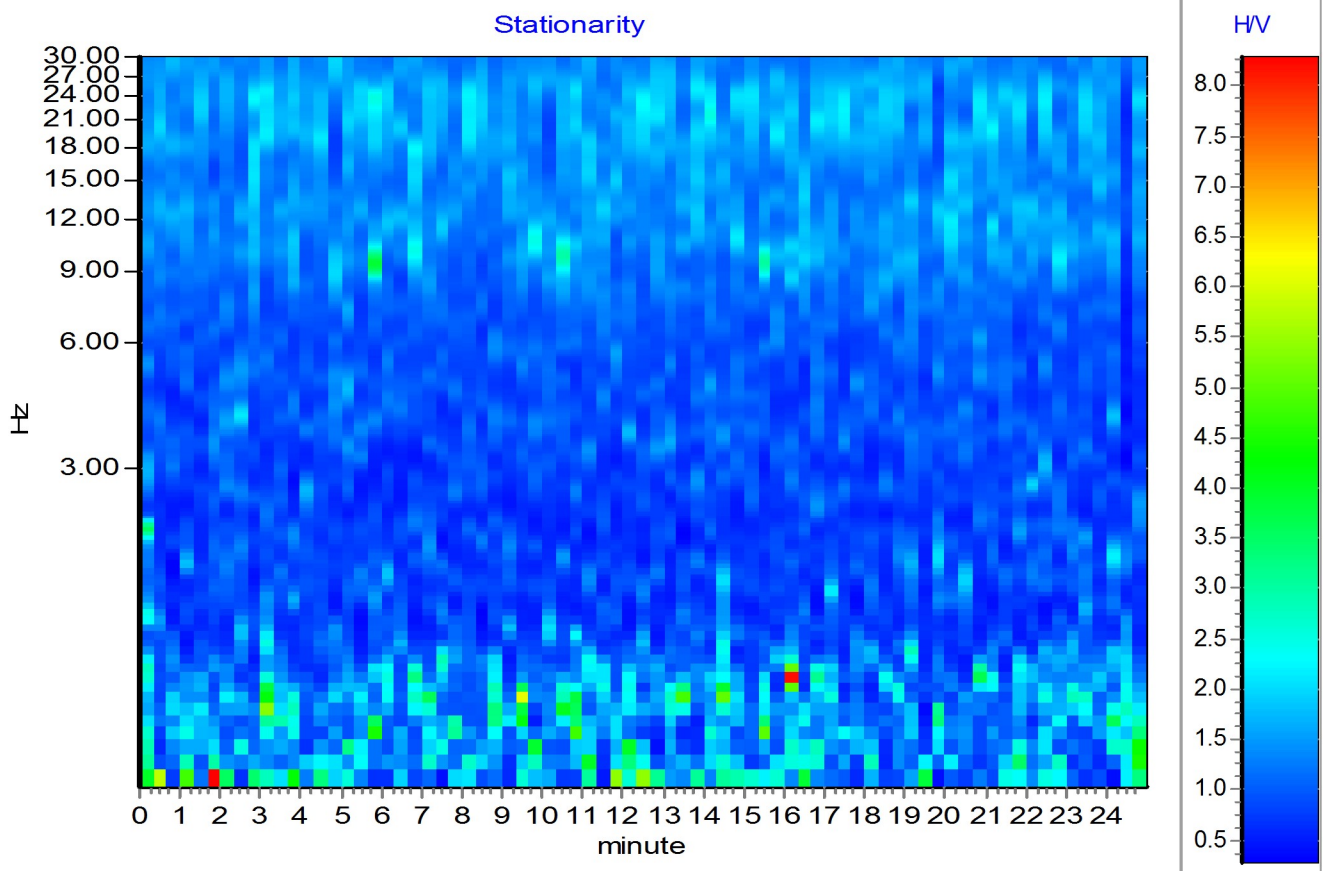
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

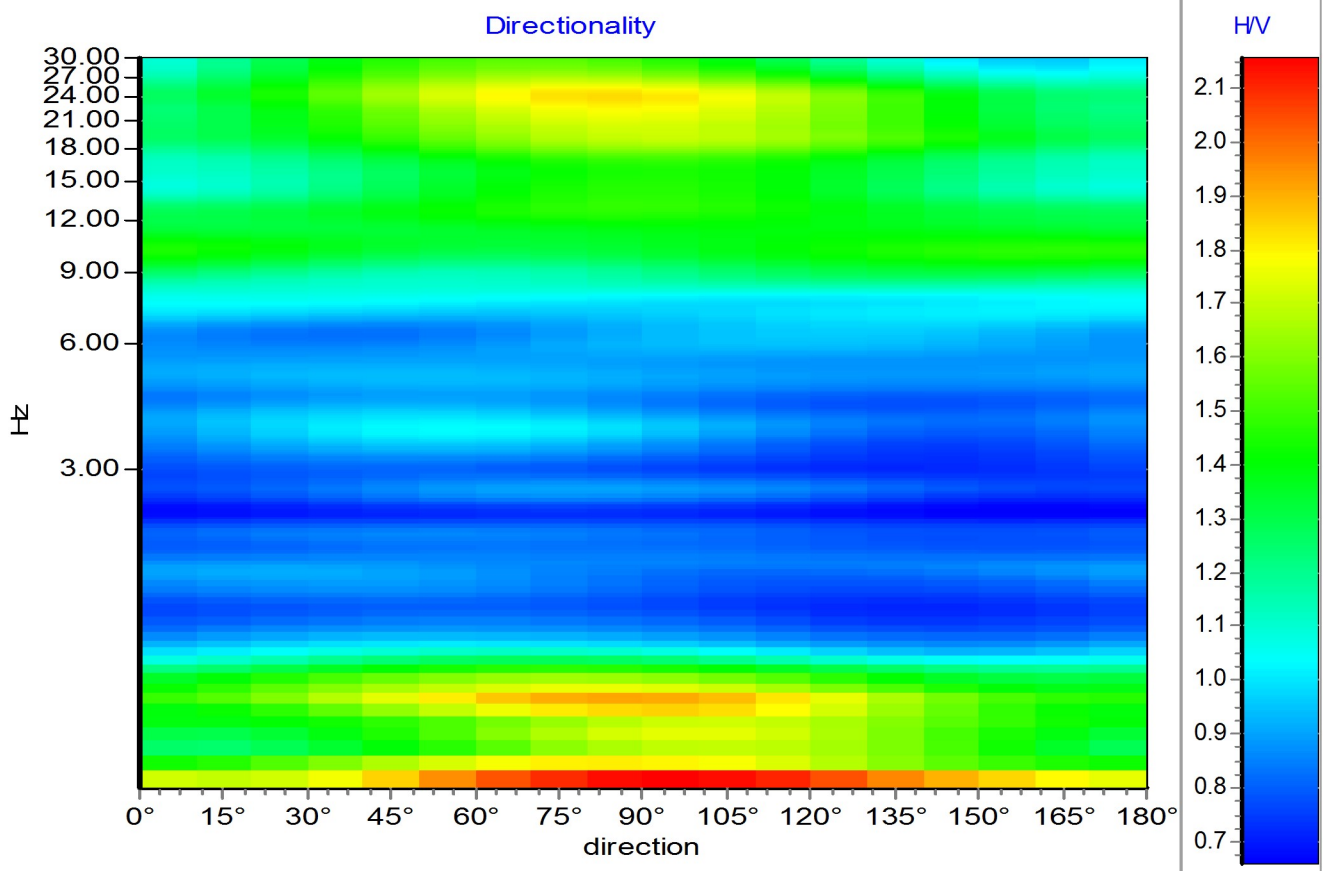
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **31 Abetaia**





Misura 32 HVRS

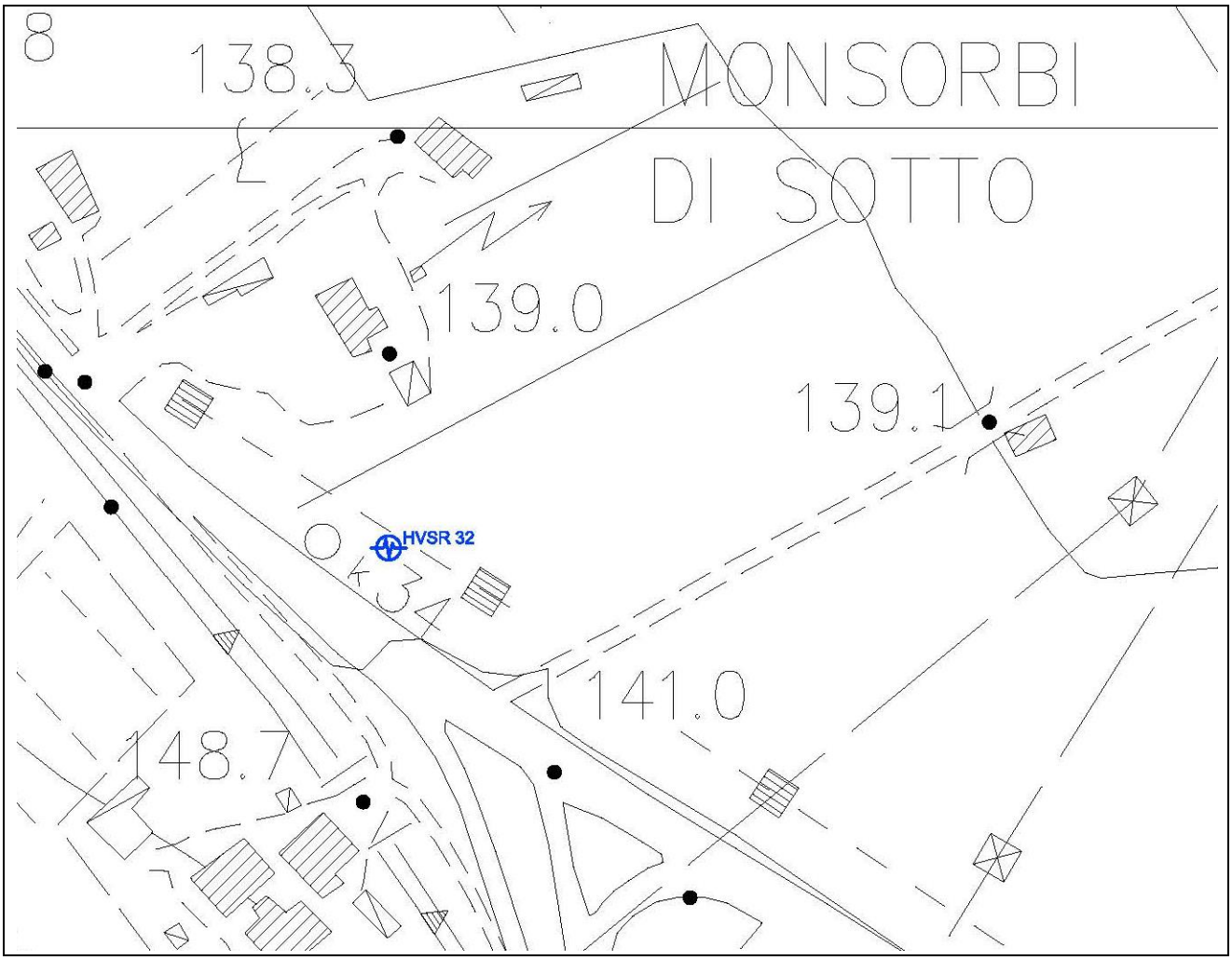


Figura 3.1 – individuazione del sito di studio - scala 1:2.000

Figura 3.2: rilievo sismico

H/V Spectral ratio

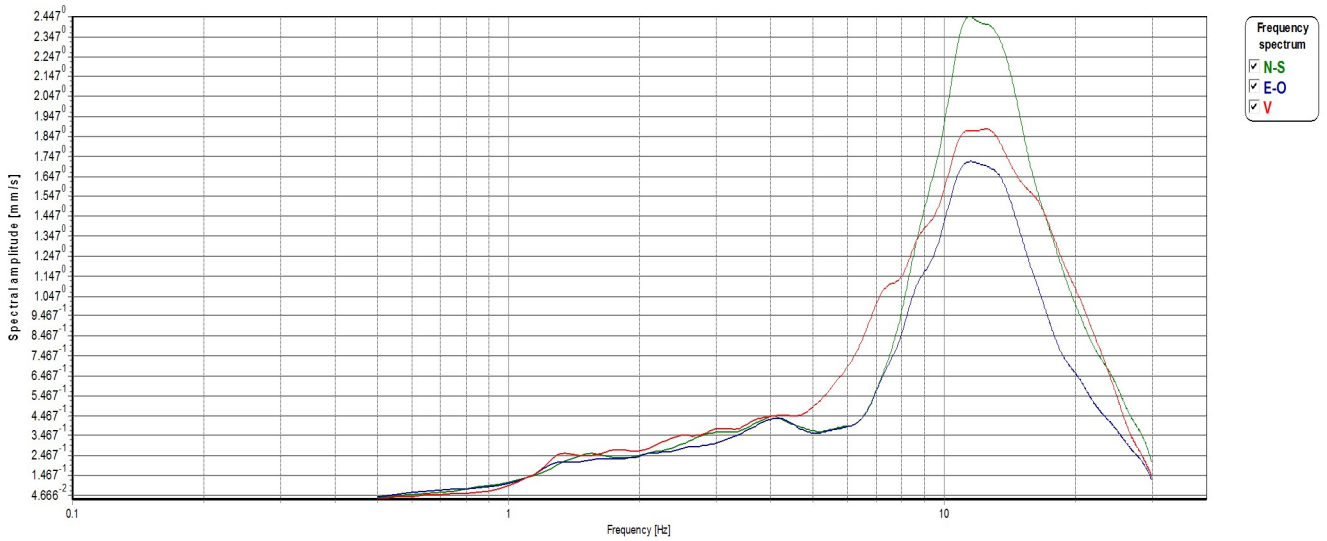
Analysis site: **Montevarchi**

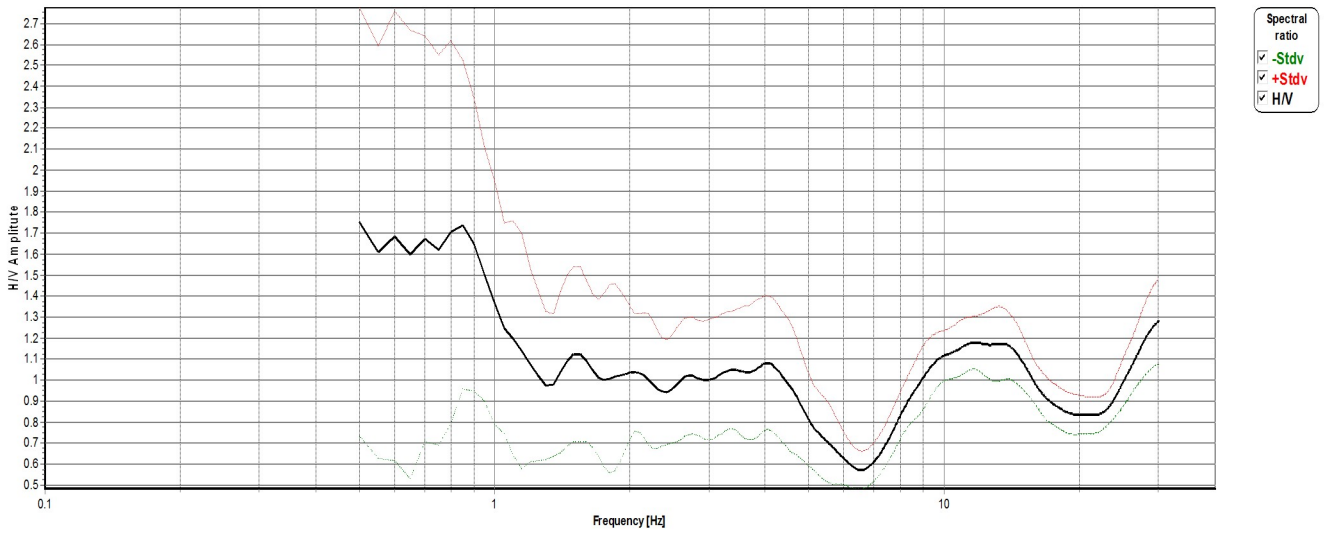
Measure point: **32 Metano**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 11:31:41**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 12:06:41**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**85**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**20**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.688**	Standard deviation [Hz]:	**0.150**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **32 Metano**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.69 >= 0.50**	**Yes**
Nc(fø) > 200	**1169.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 18**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.67 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**4262.70% > 5.00%**	**No**
sf < e(fø)	**0.1505 > 0.1031**	**No**
sA(fø) < ?(fø)	**0.9671 < 2.0000**	**Yes**

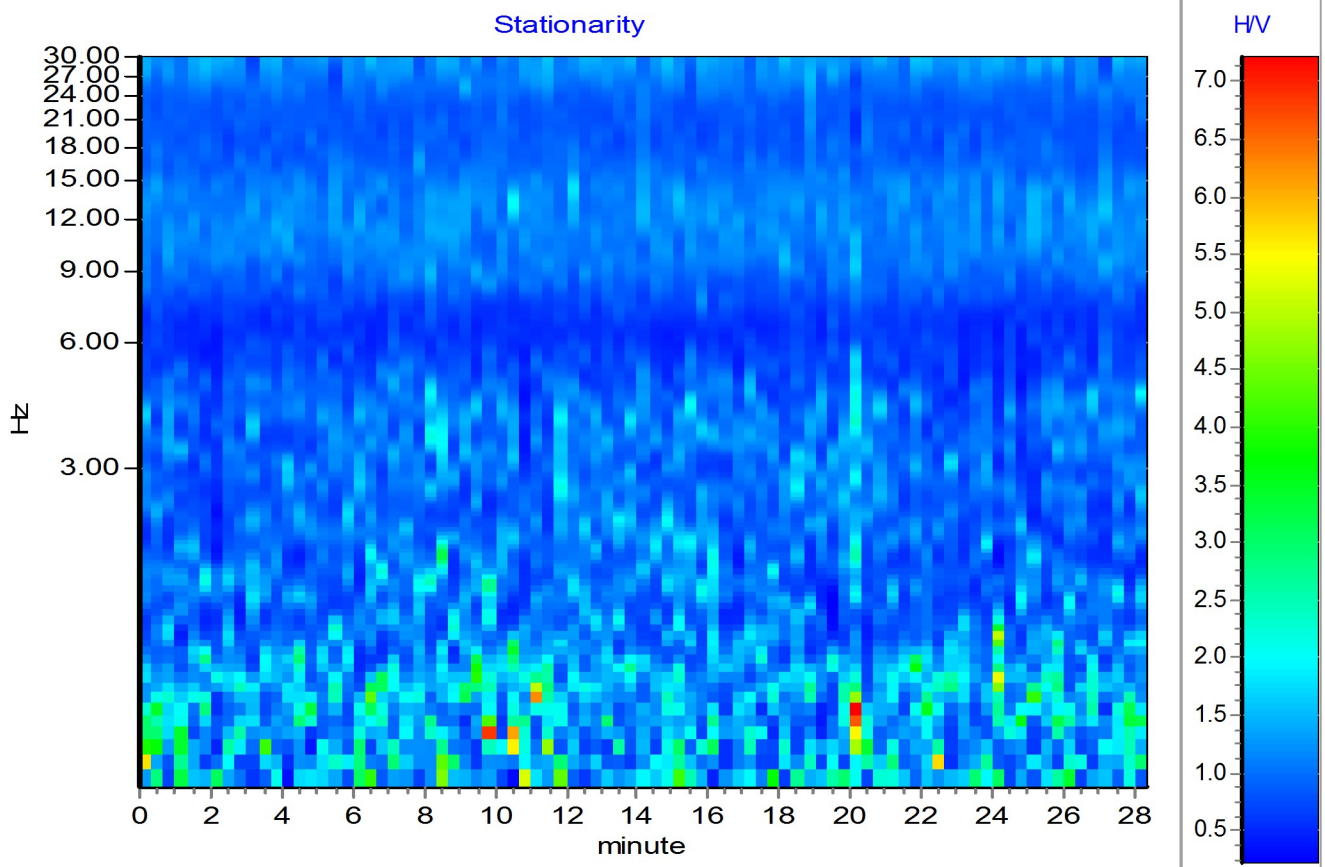
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

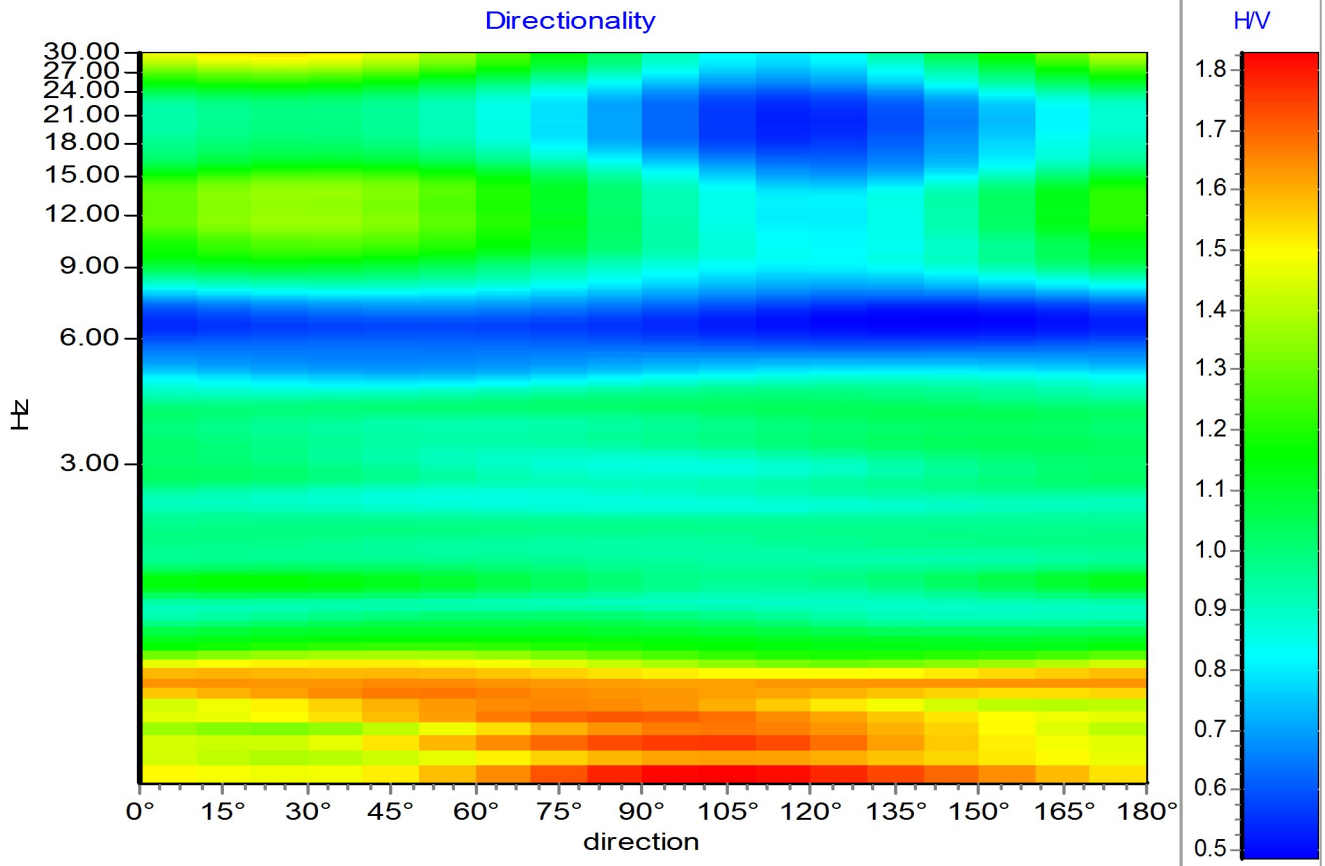
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **32 Metano**





Misura 33 HVRS

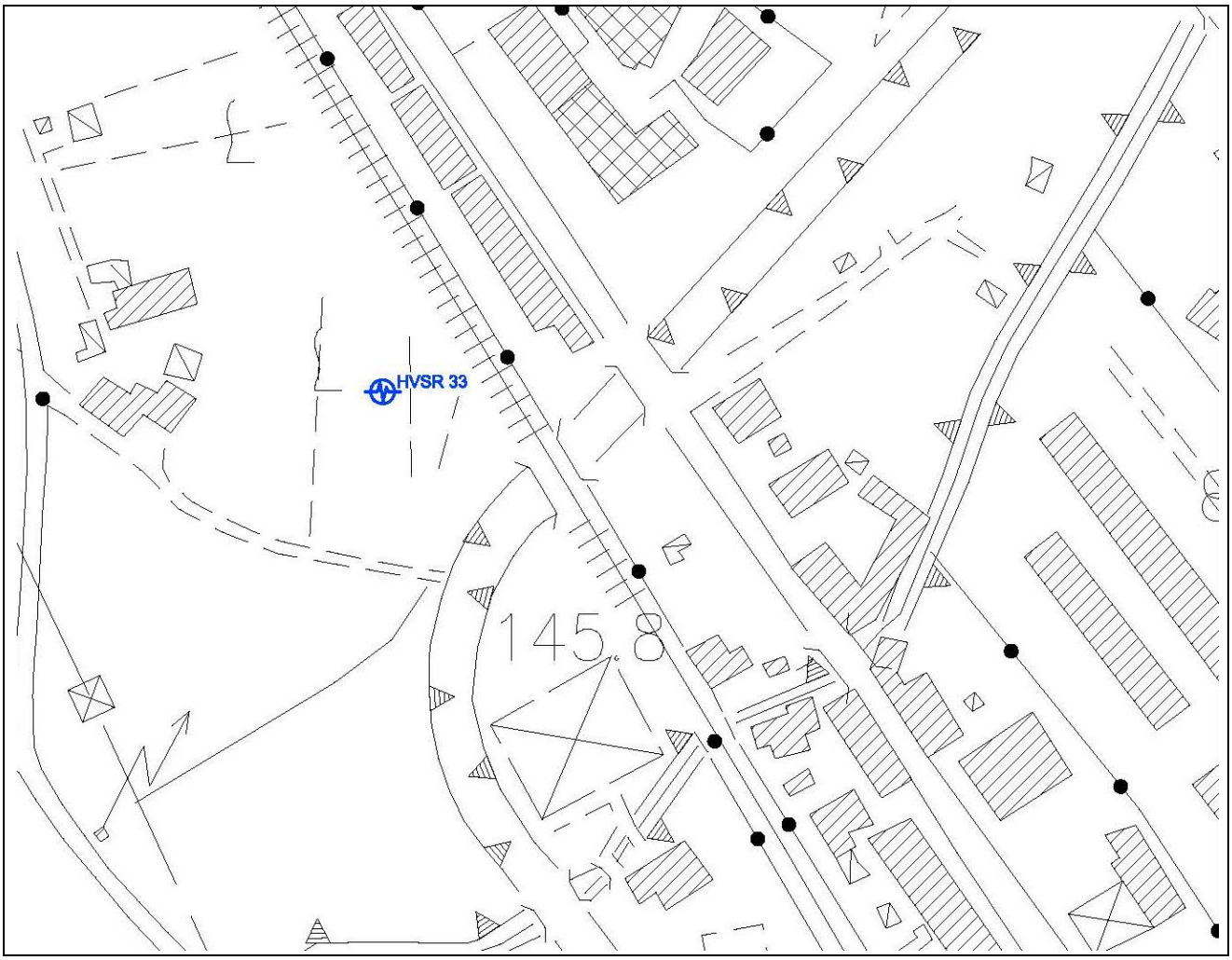


Figura 4.1 – individuazione del sito di studio - scala 1:2.000

Figura 4.2: rilievo sismico

H/V Spectral ratio

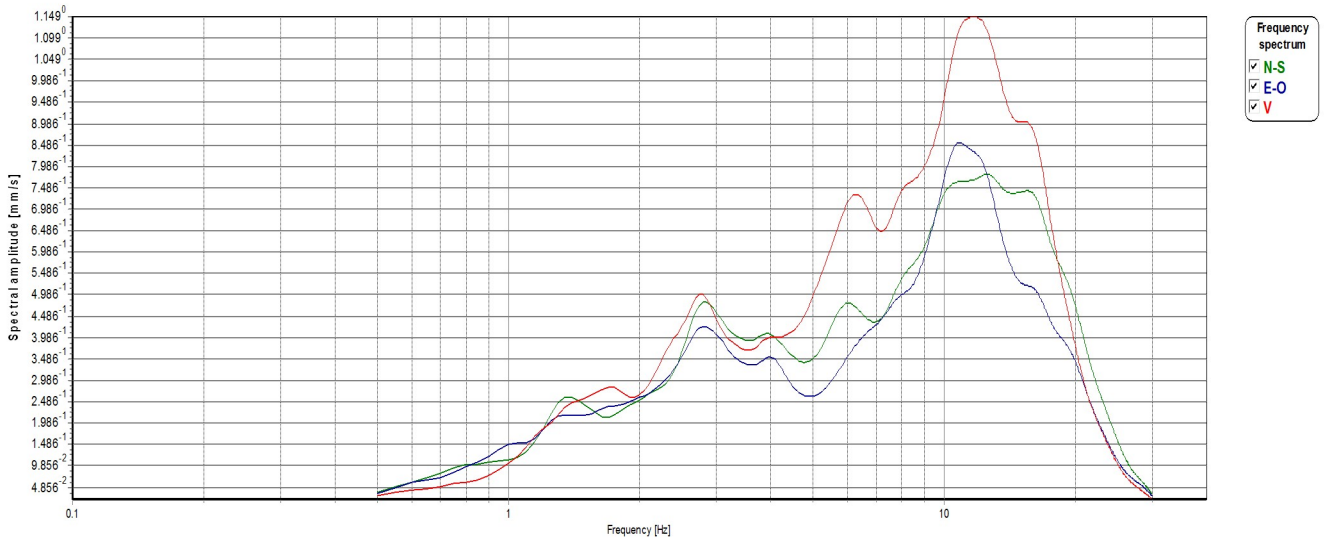
Analysis site: **Montevarchi**

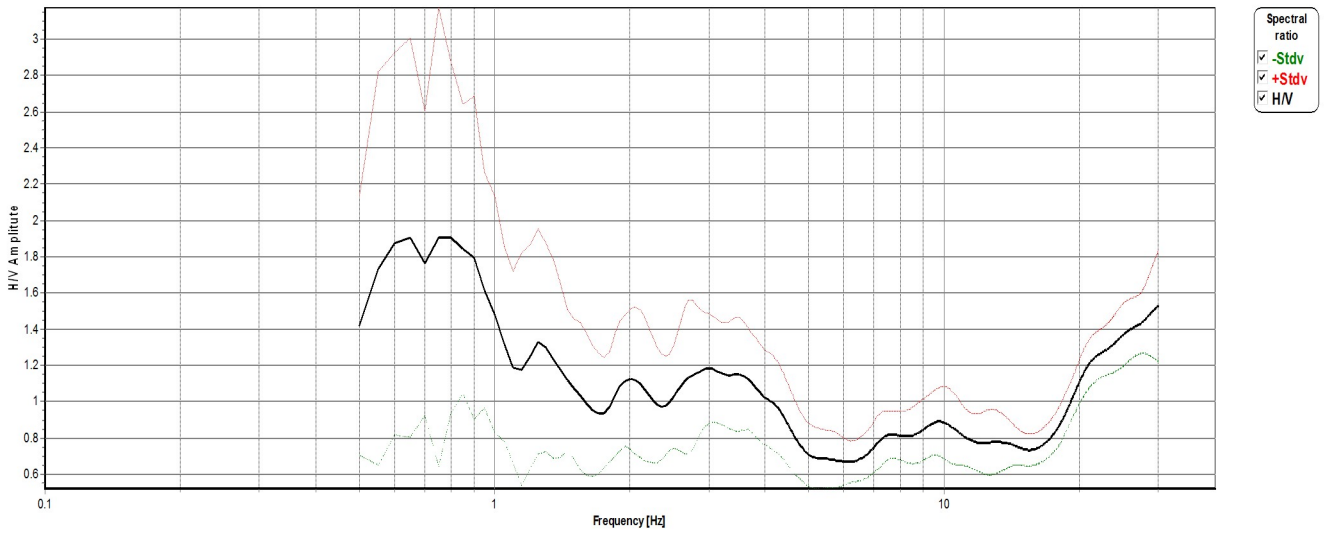
Measure point: **33 Sottopasso**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 10:40:37**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 11:15:37**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**79**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**26**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.940**	Standard deviation [Hz]:	**5.590**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **33 Sottopasso**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.94 >= 0.50**	**Yes**
Nc(fø) > 200	**3065.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 58**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.12 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**1322.80% > 5.00%**	**No**
sf < e(fø)	**5.5897 > 0.1940**	**No**
sA(fø) < ?(fø)	**0.3641 < 1.7800**	**Yes**

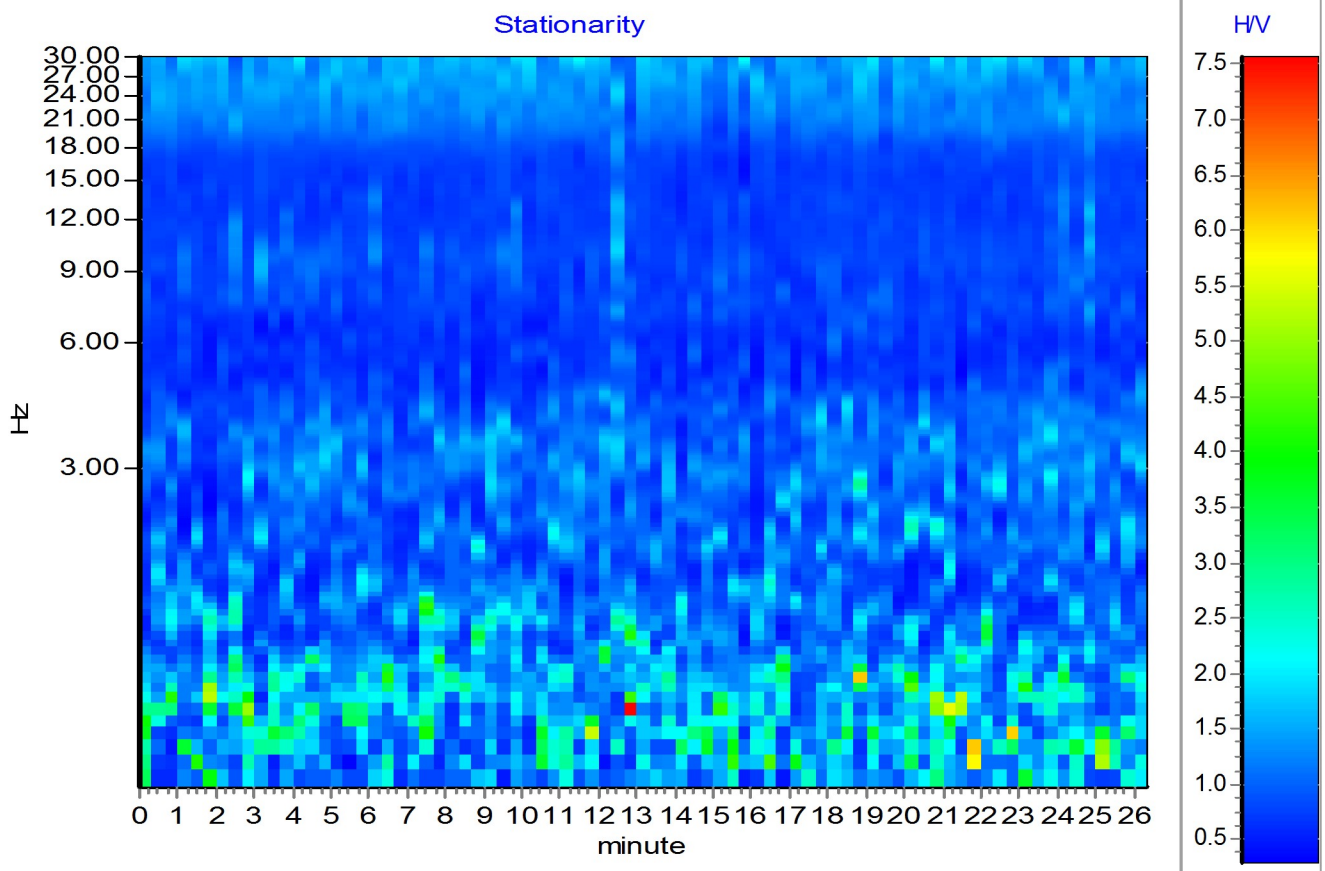
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

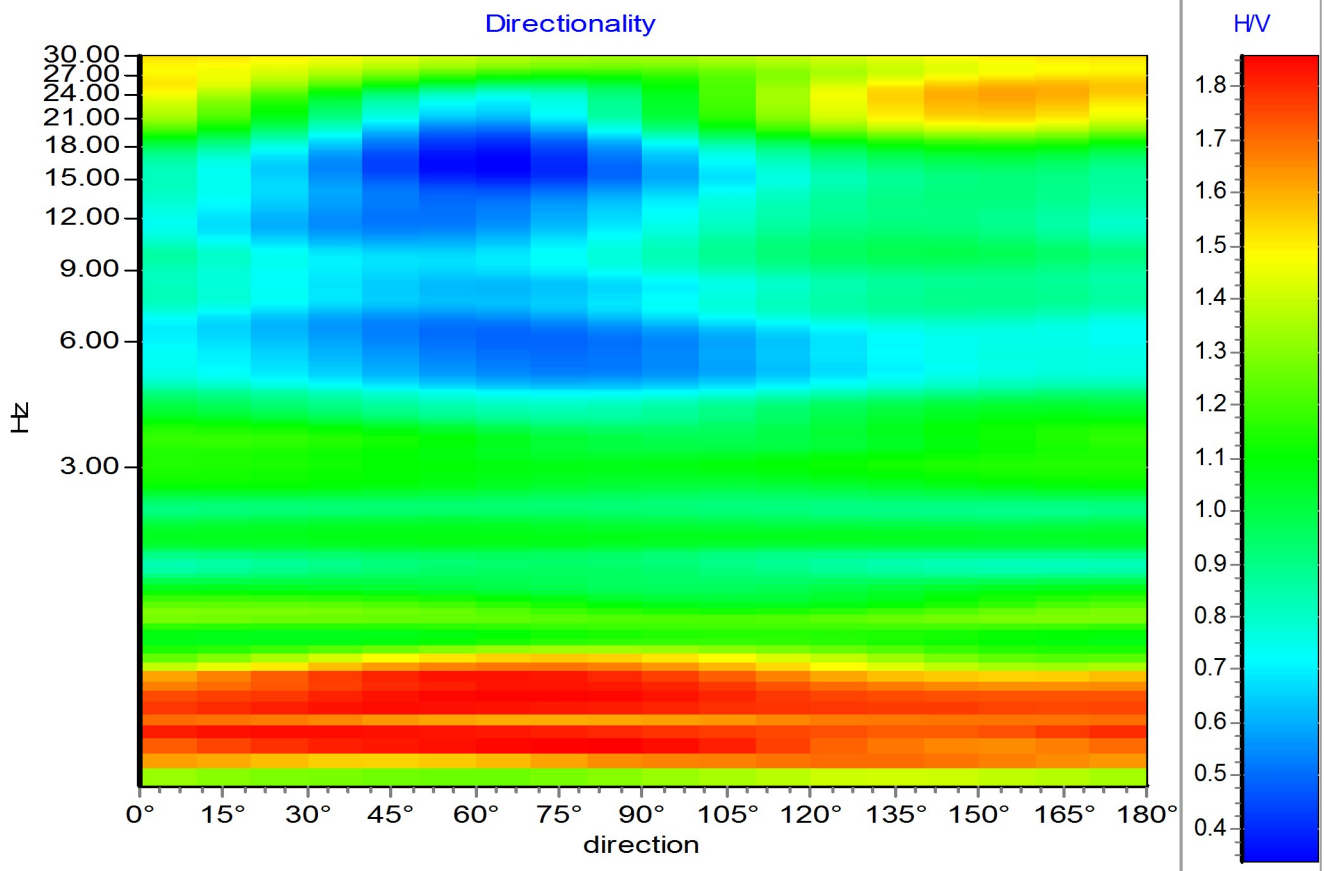
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **33 Sottopasso**





Misura 34 HVRS

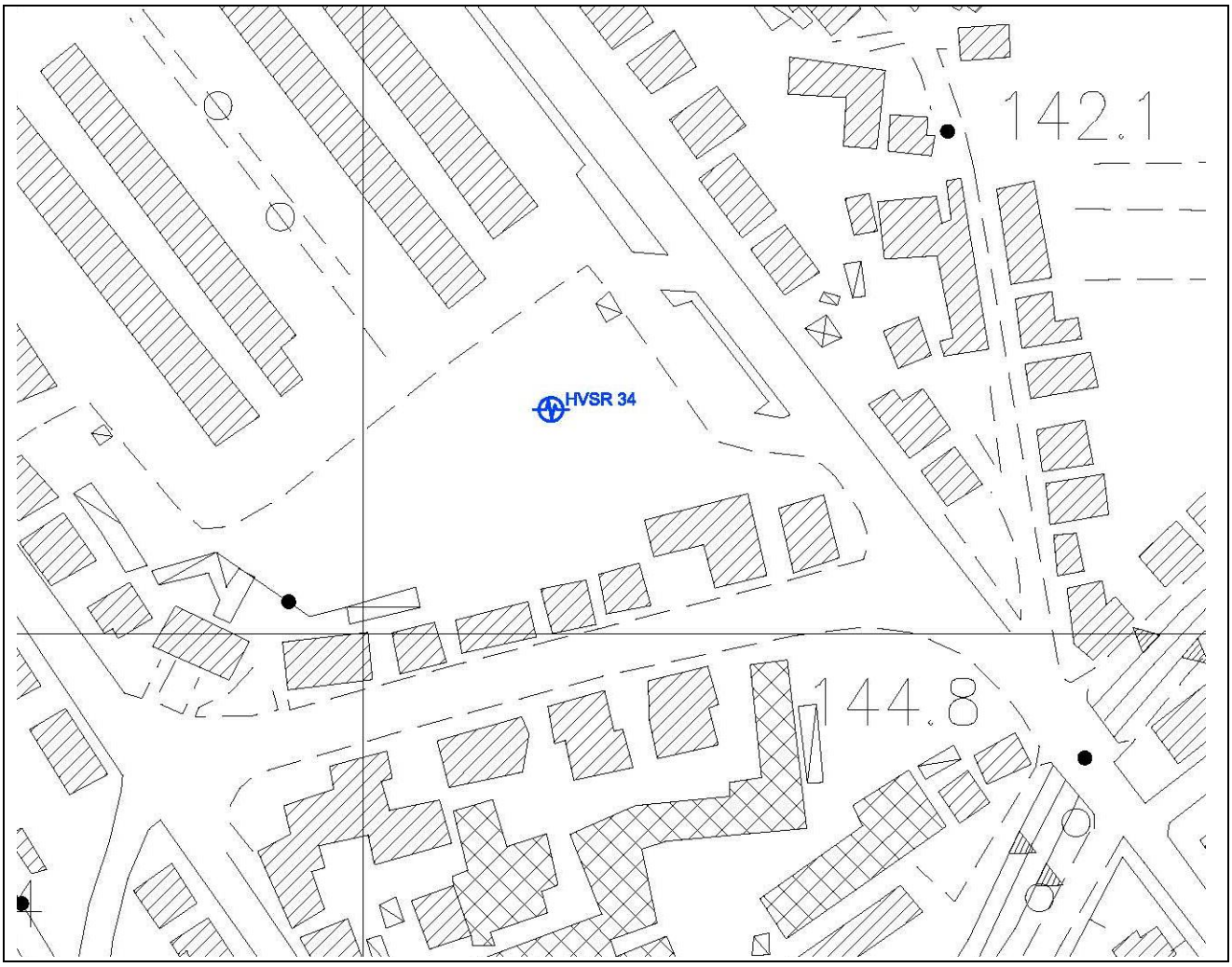


Figura 5.1 – individuazione del sito di studio - scala 1:2.000

Figura 5.2: rilievo sismico

H/V Spectral ratio

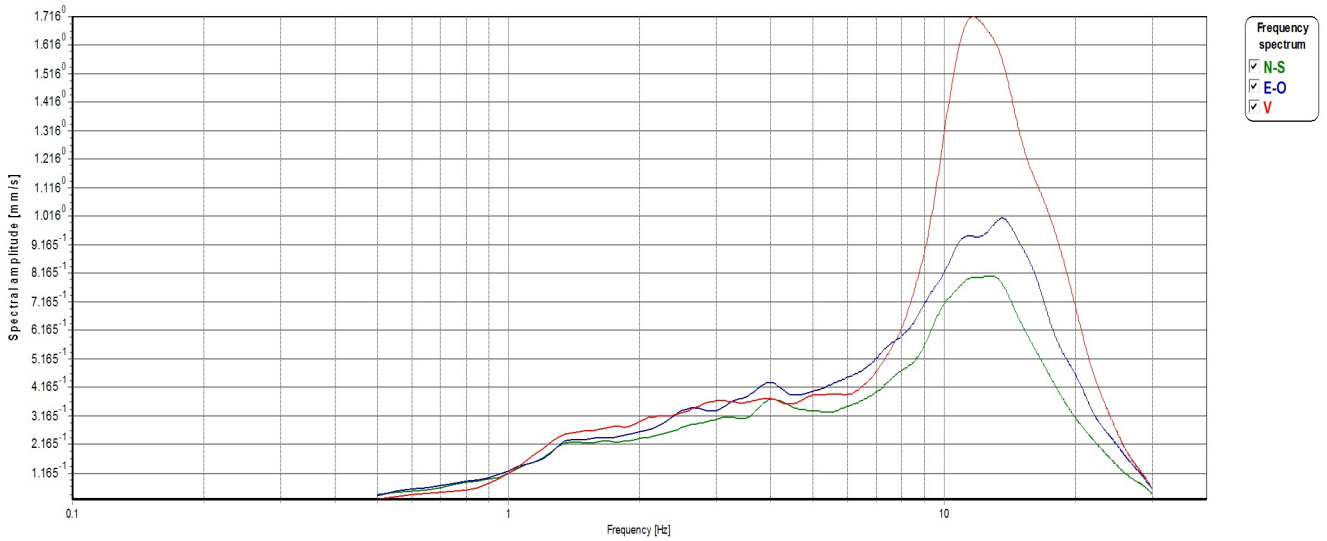
Analysis site: **Montevarchi**

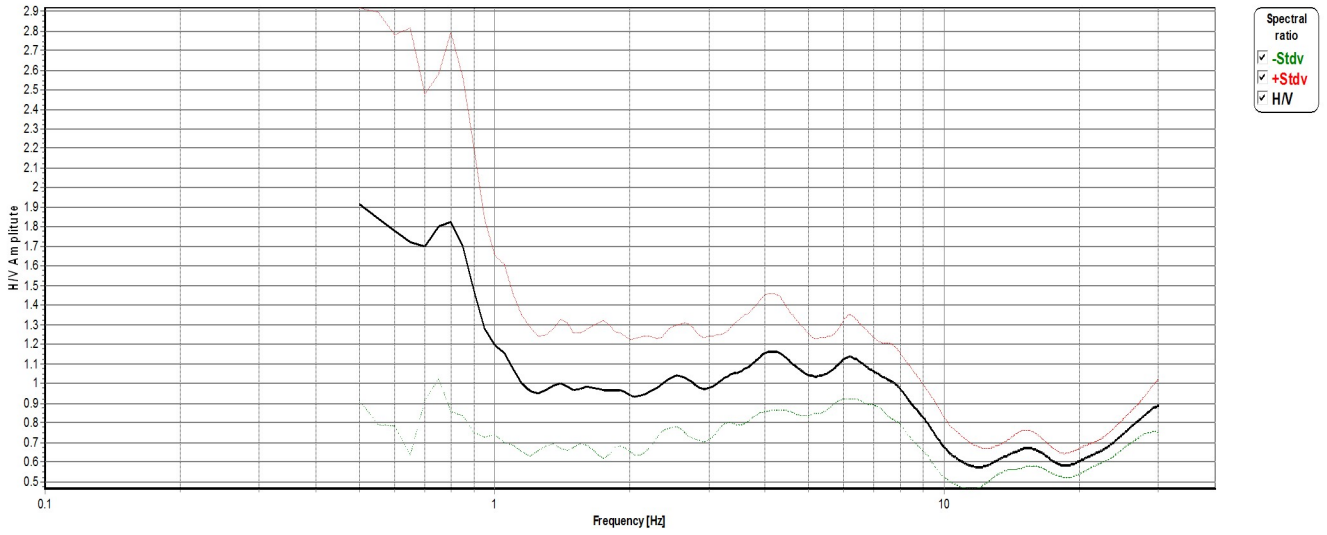
Measure point: **34 Condomini**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 09:54:42**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 10:29:42**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**82**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**23**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.660**	Standard deviation [Hz]:	**0.130**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **34 Condomini**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.66 >= 0.50**	**Yes**
Nc(fø) > 200	**1082.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 17**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.72 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**24.21% > 5.00%**	**No**
sf < e(fø)	**0.1301 > 0.0990**	**No**
sA(fø) < ?(fø)	**1.0890 < 2.0000**	**Yes**

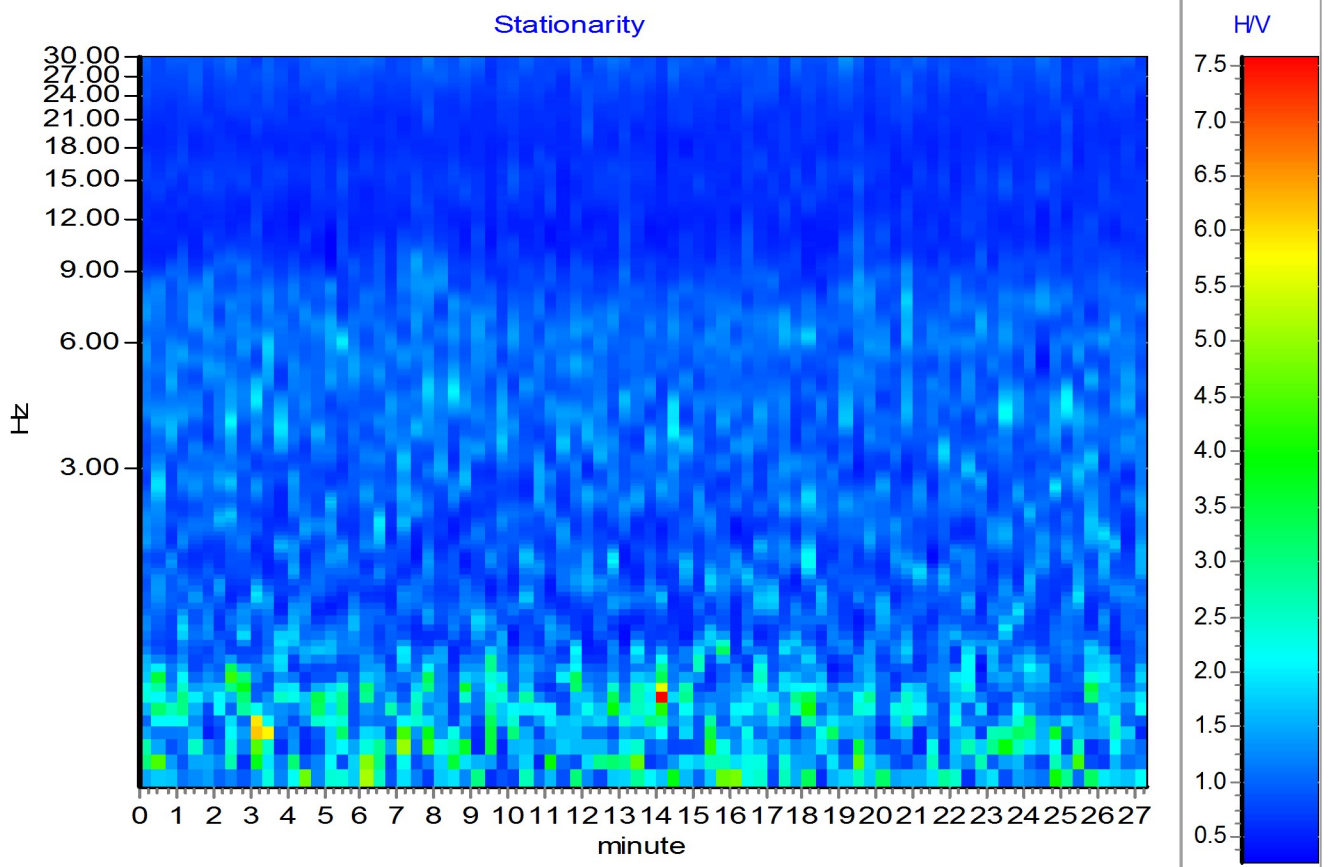
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

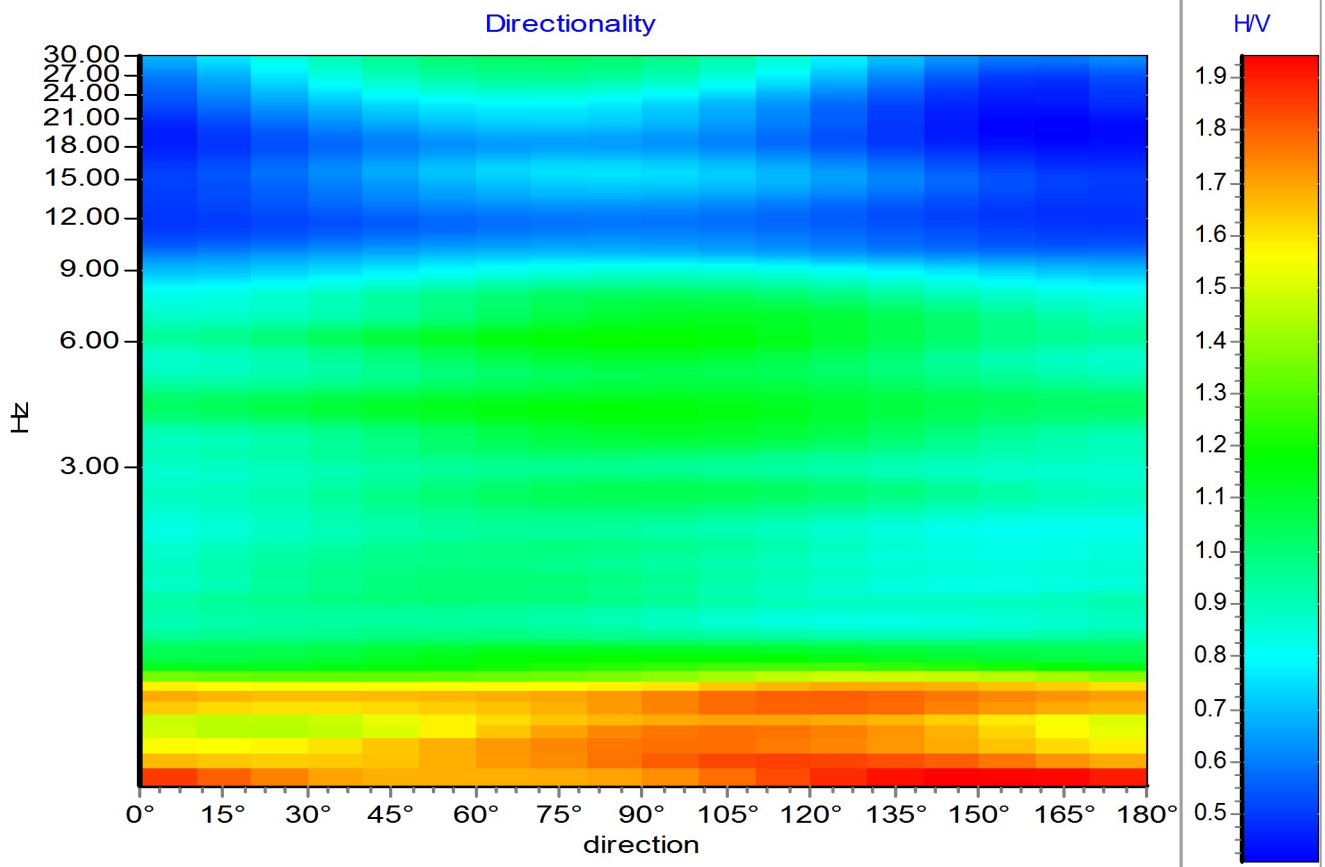
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **34 Condomini**





Misura 35 HVRS

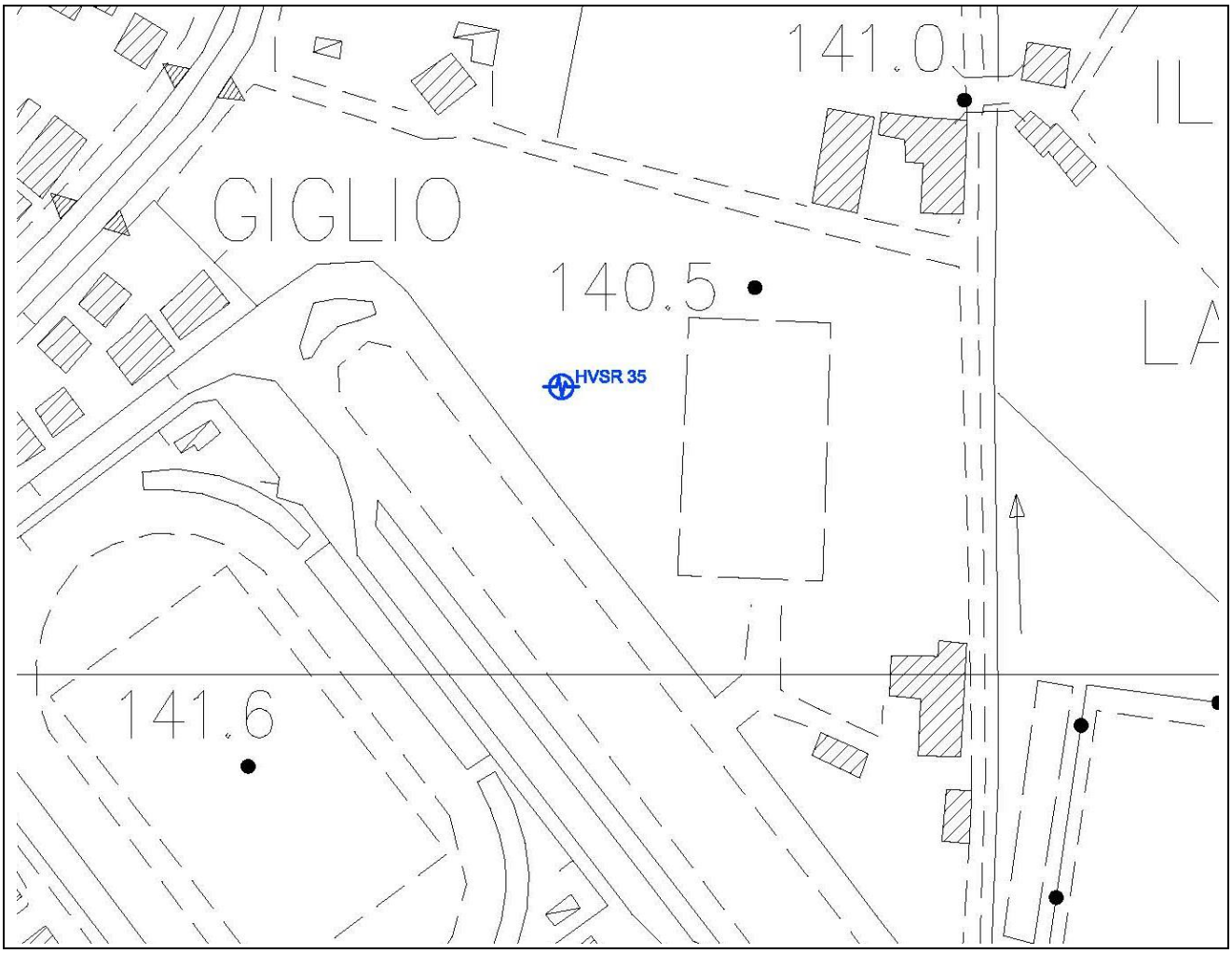


Figura 6.1 – individuazione del sito di studio - scala 1:2.000

Figura 6.2: rilievo sismico

H/V Spectral ratio

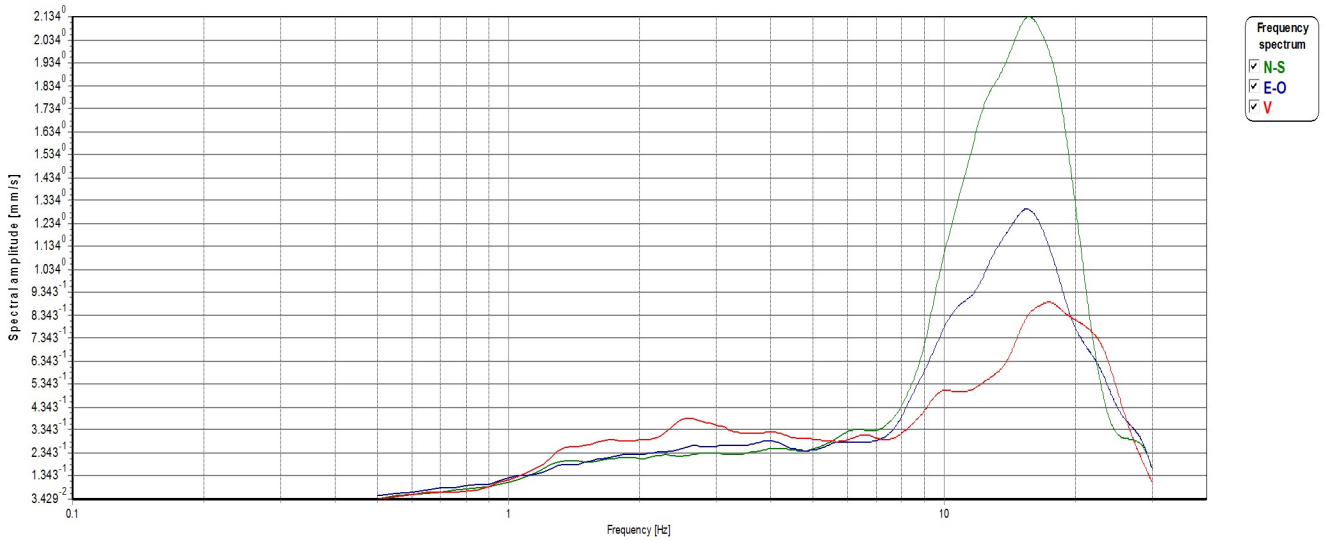
Analysis site: **Montevarchi**

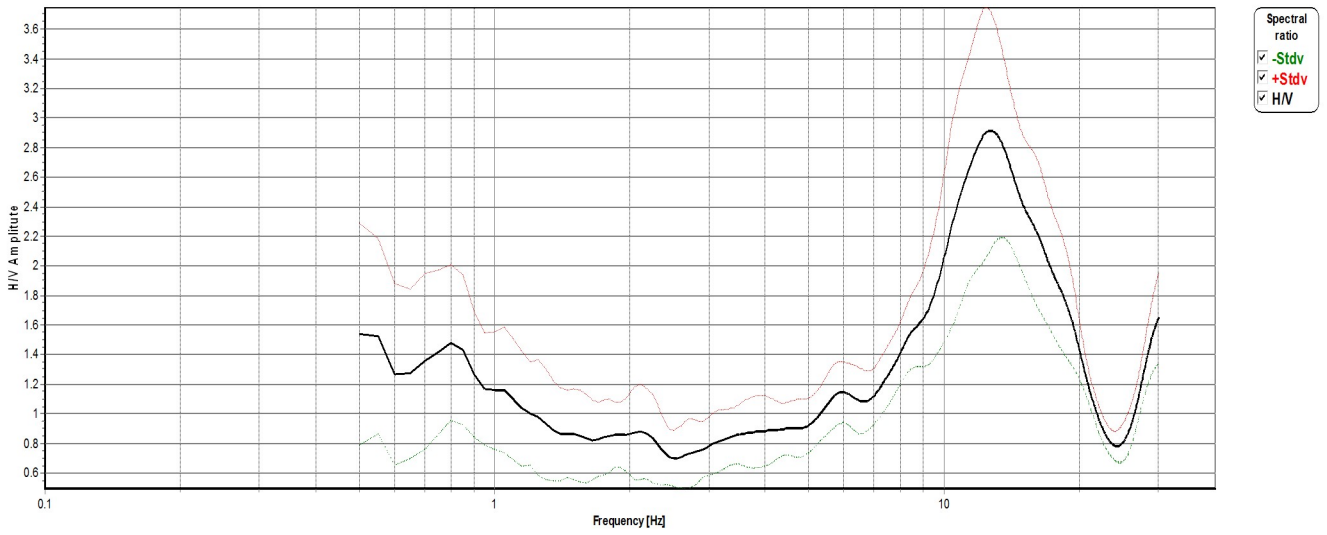
Measure point: **35 Supermercato**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 14:44:28**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 15:19:28**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**63**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**42**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**12.790**	Standard deviation [Hz]:	**1.364**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **35 Supermercato**

Criteria for a reliable H/V curve		
fø > 10/Lw	**12.79 >= 0.50**	**Yes**
Nc(fø) > 200	**16115.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 384**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**3.200**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**19.900**	**Yes**
Aø > 2	**2.91 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**5.16% > 5.00%**	**No**
sf < e(fø)	**1.3639 > 0.6395**	**No**
sA(fø) < ?(fø)	**0.7777 < 1.5800**	**Yes**

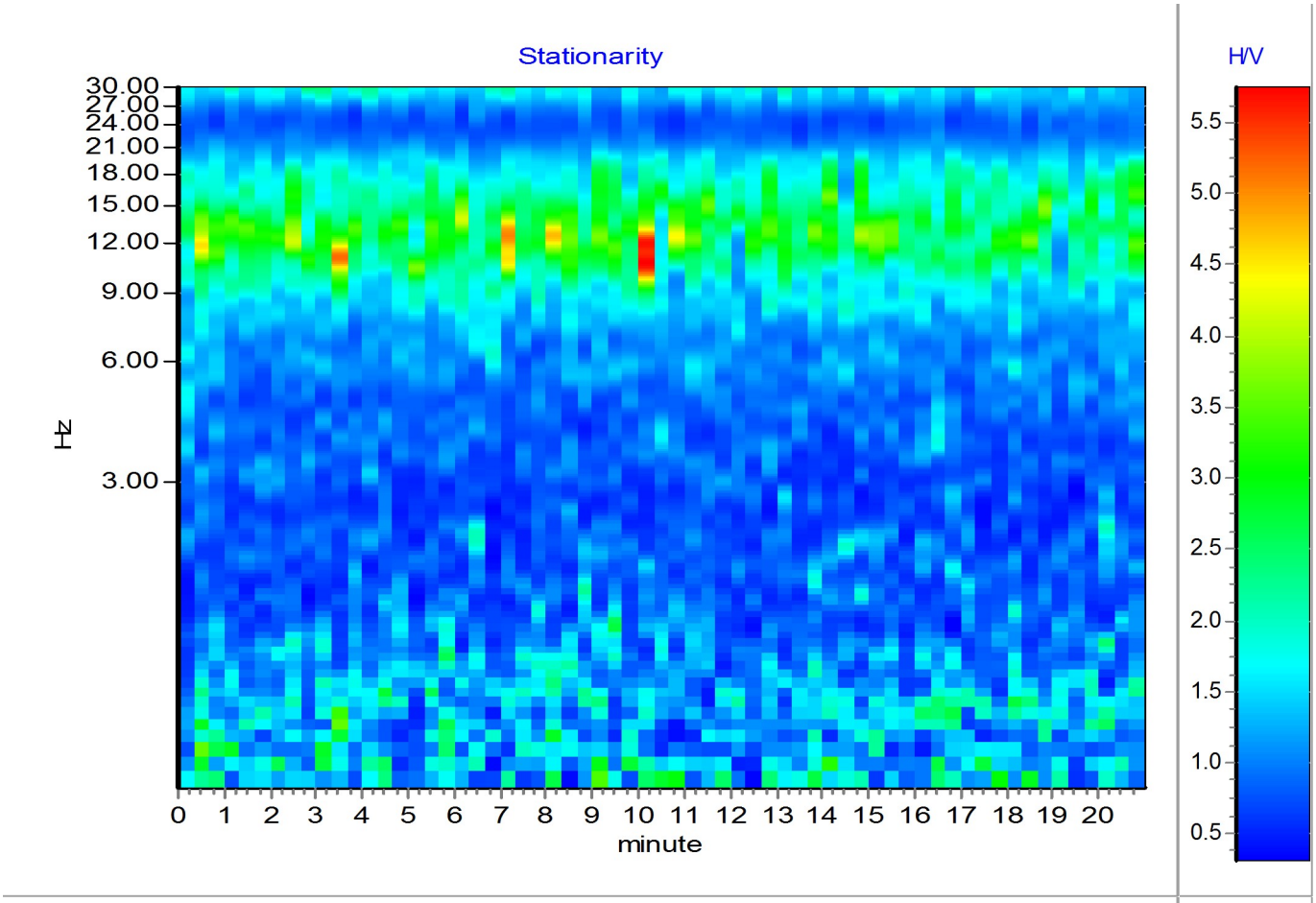
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

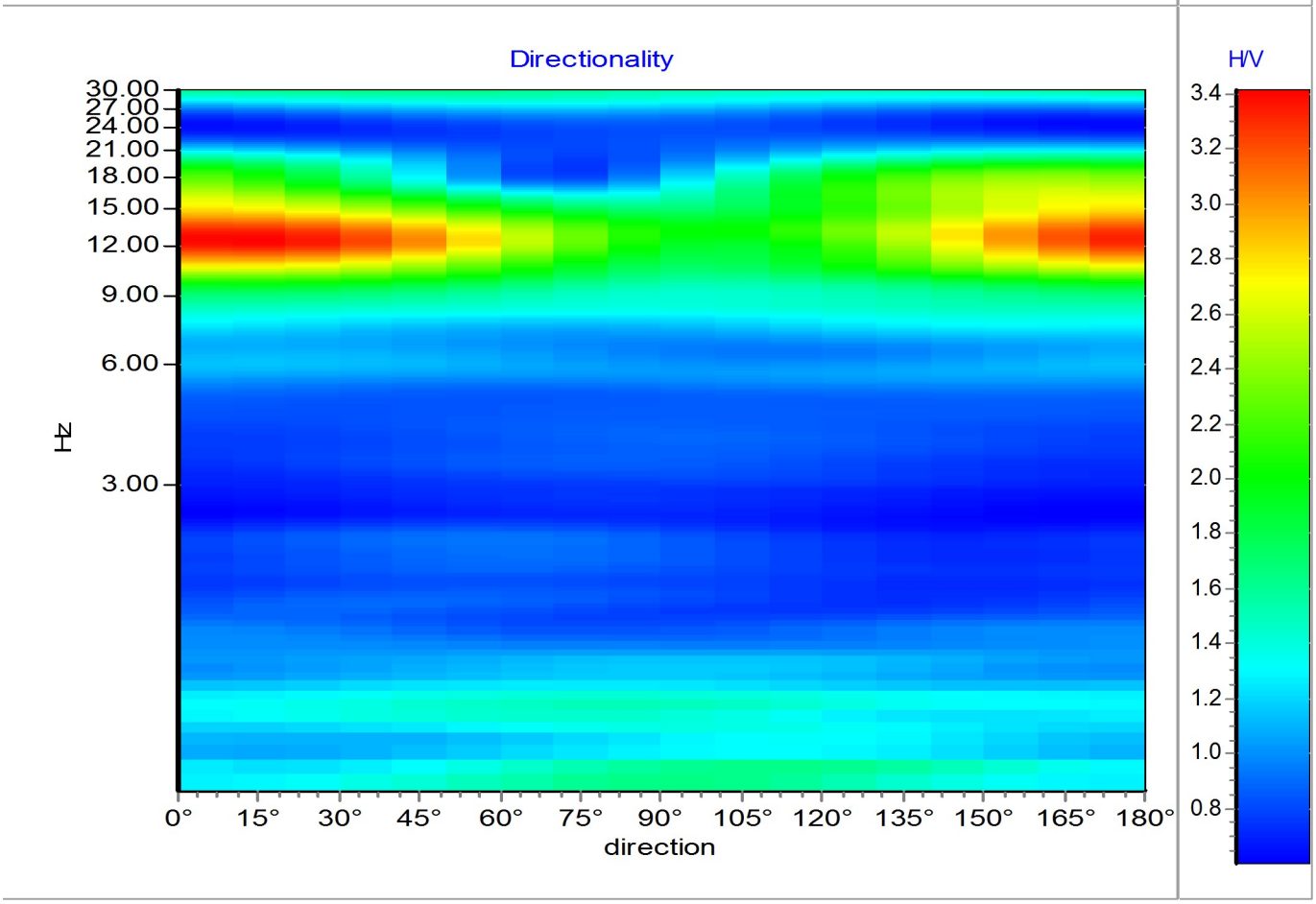
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **35 Supermercato**





Misura 36 HVRS

Figura 7.1 – individuazione del sito di studio - scala 1:2.000

Figura 7.2: rilievo sismico

H/V Spectral ratio

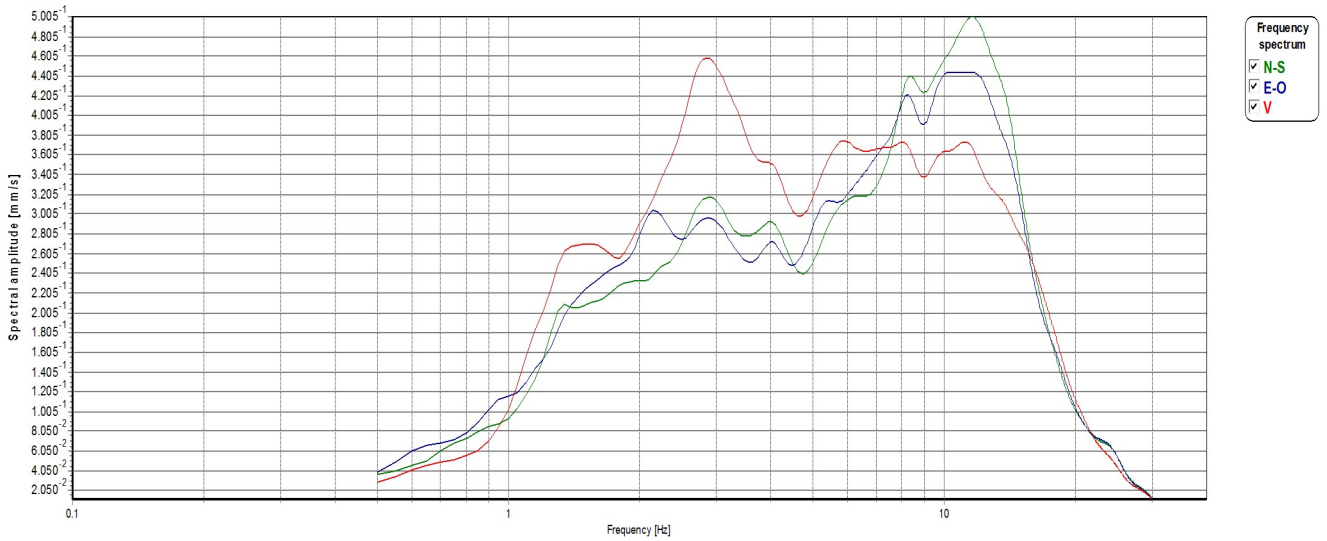
Analysis site: **Montevarchi**

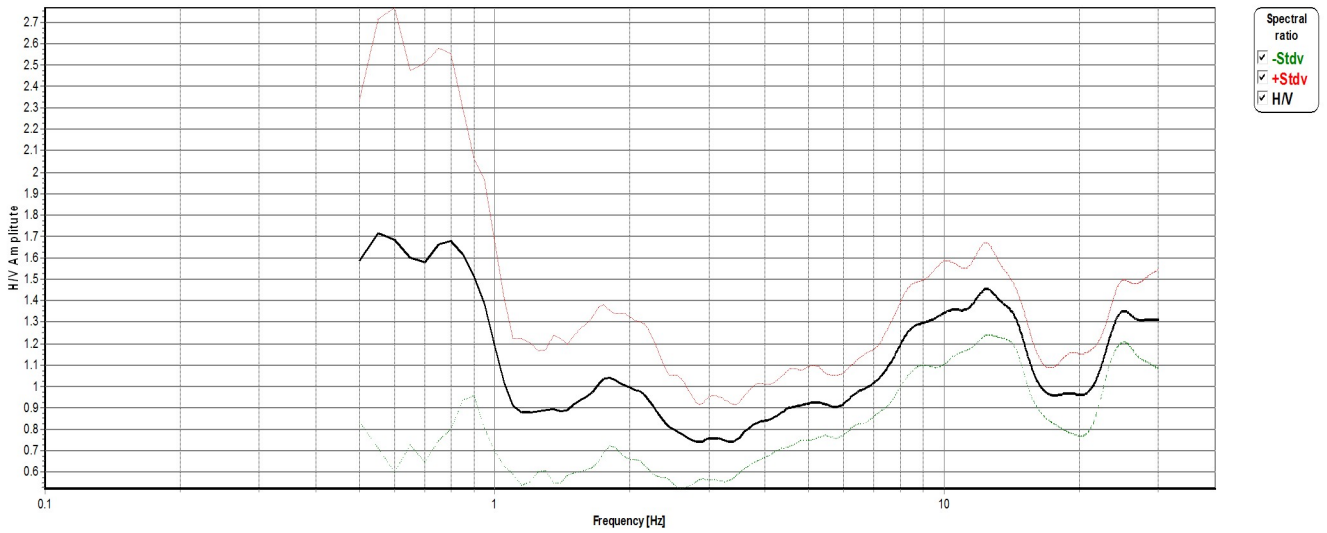
Measure point: **36 Argine**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 13:56:14**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 14:31:14**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**87**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**18**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.715**	Standard deviation [Hz]:	**0.213**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **36 Argine**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.71 >= 0.50**	**Yes**
Nc(fø) > 200	**1244.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 19**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.600**	**Yes**
Aø > 2	**1.58 < 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**1655.40% > 5.00%**	**No**
sf < e(fø)	**0.2132 > 0.1072**	**No**
sA(fø) < ?(fø)	**0.9301 < 2.0000**	**Yes**

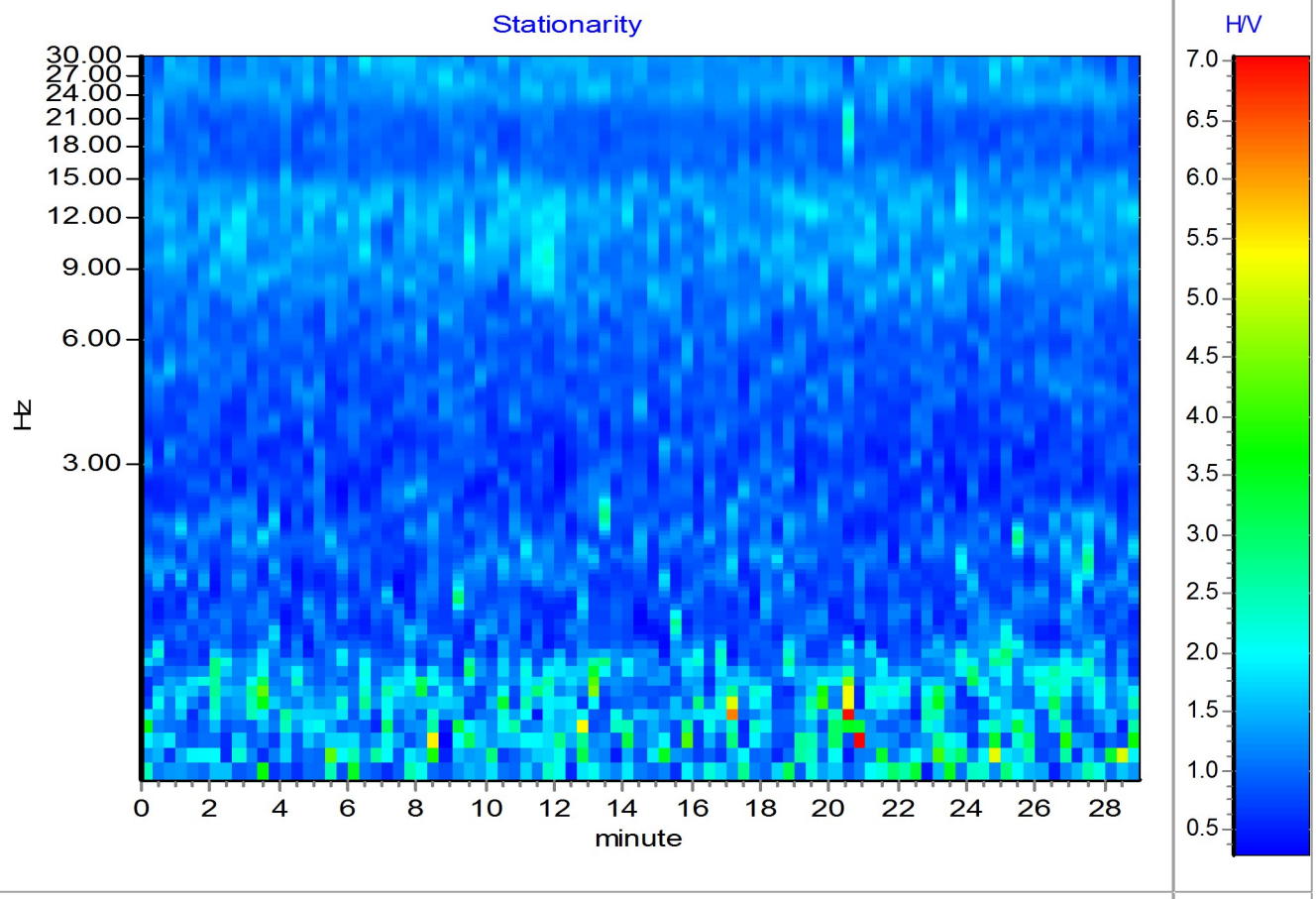
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

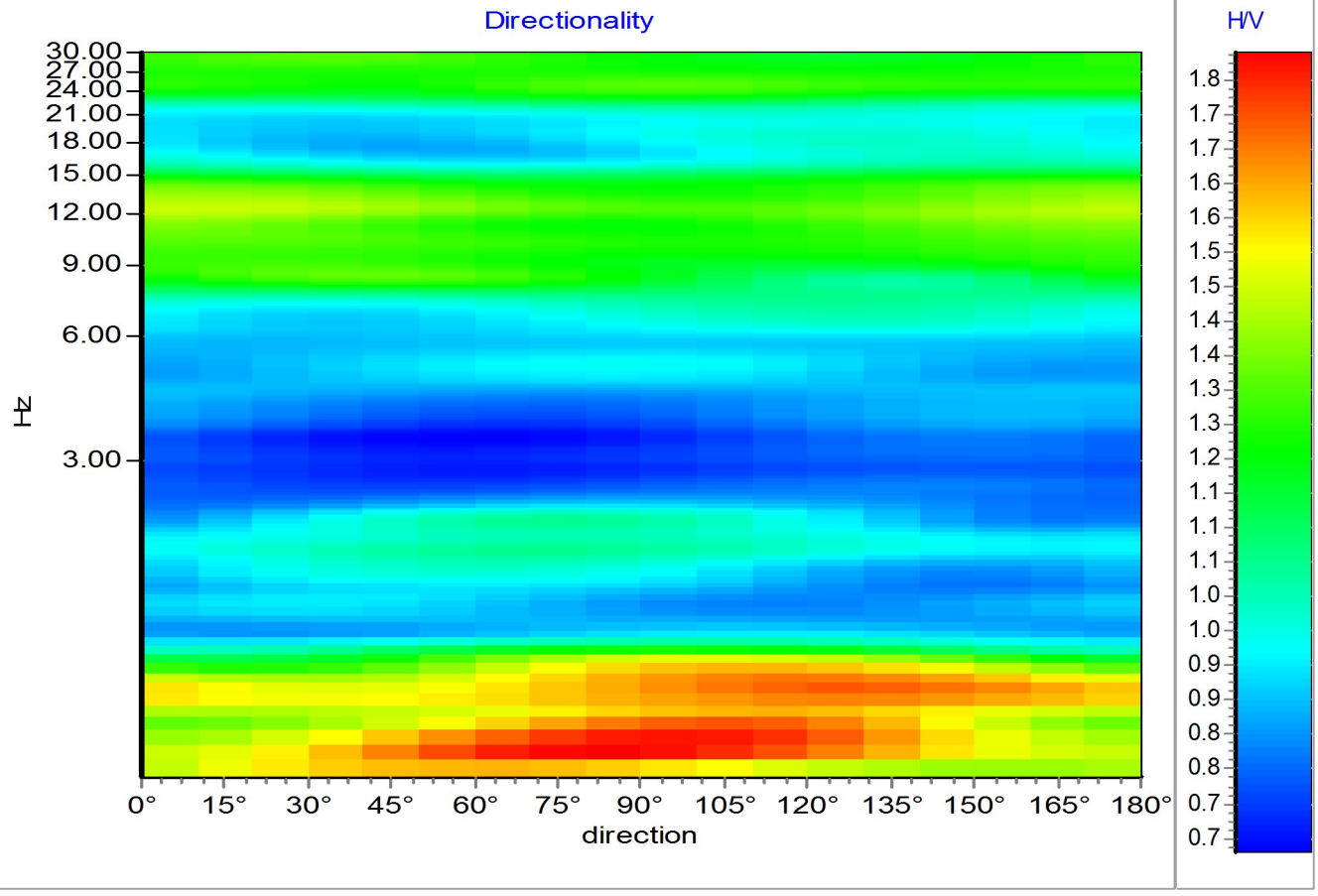
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **36 Argine**





Misura 37 HVRS

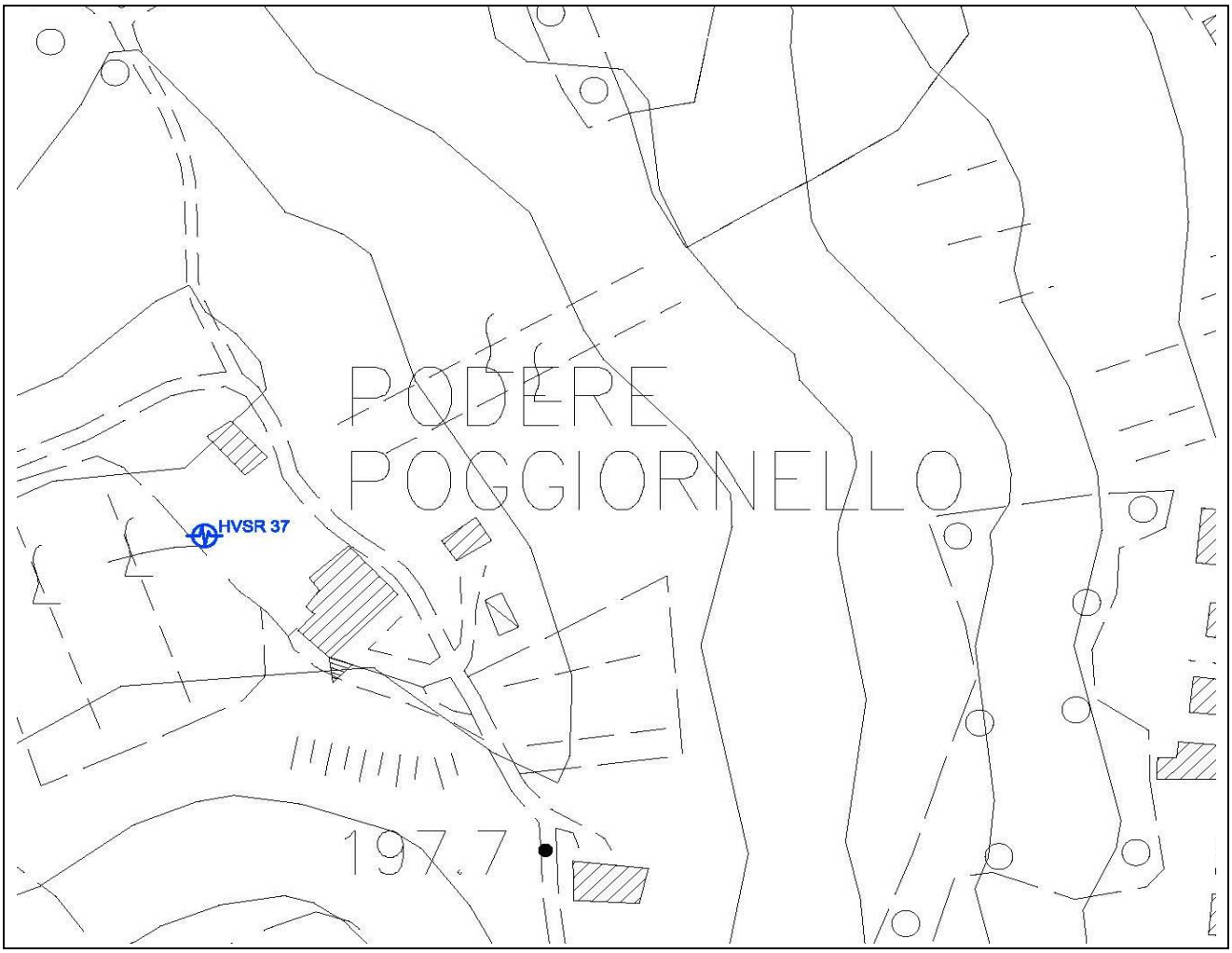


Figura 8.1 – individuazione del sito di studio - scala 1:2.000

Figura 8.2: rilievo sismico

H/V Spectral ratio

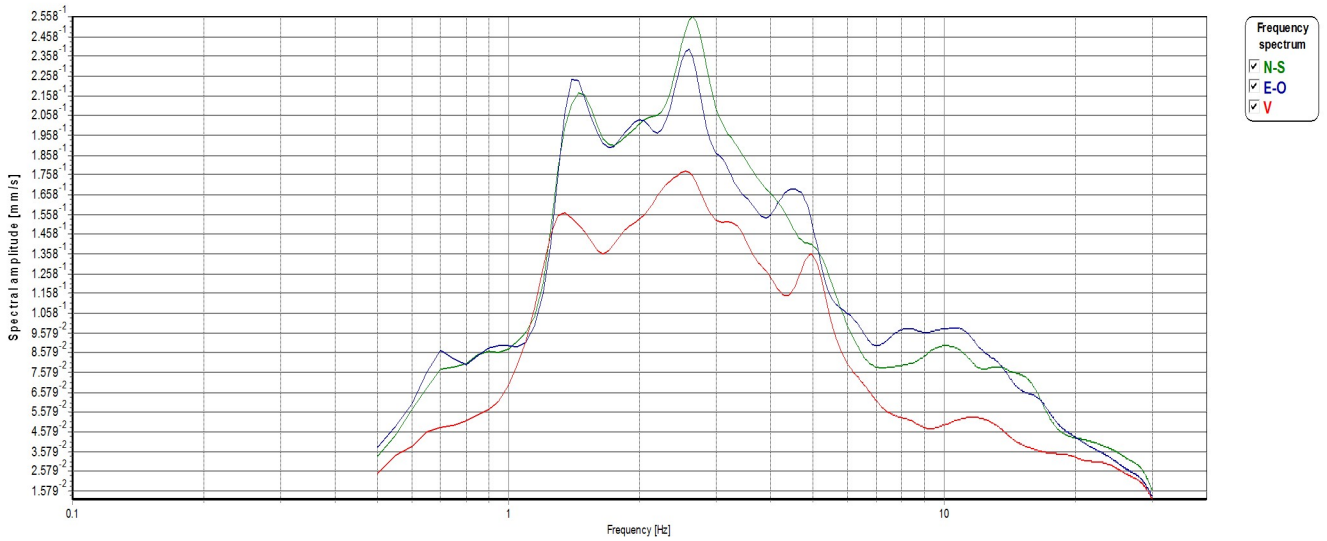
Analysis site: **Montevarchi**

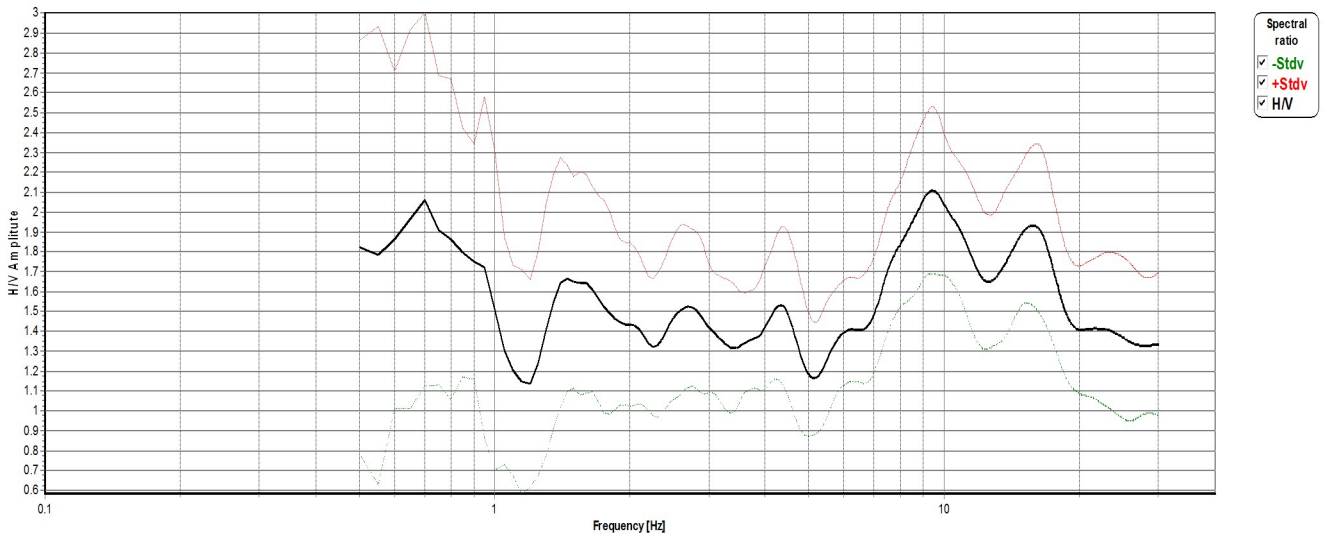
Measure point: **37 Podere Poggiarello**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 18:53:03**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 19:28:03**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**70**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**35**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.919**	Standard deviation [Hz]:	**0.486**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **37 Podere Poggiarello**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.92 >= 0.50**	**Yes**
Nc(fø) > 200	**1287.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 27**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.75 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**922.53% > 5.00%**	**No**
sf < e(fø)	**0.4857 > 0.1379**	**No**
sA(fø) < ?(fø)	**0.5919 < 2.0000**	**Yes**

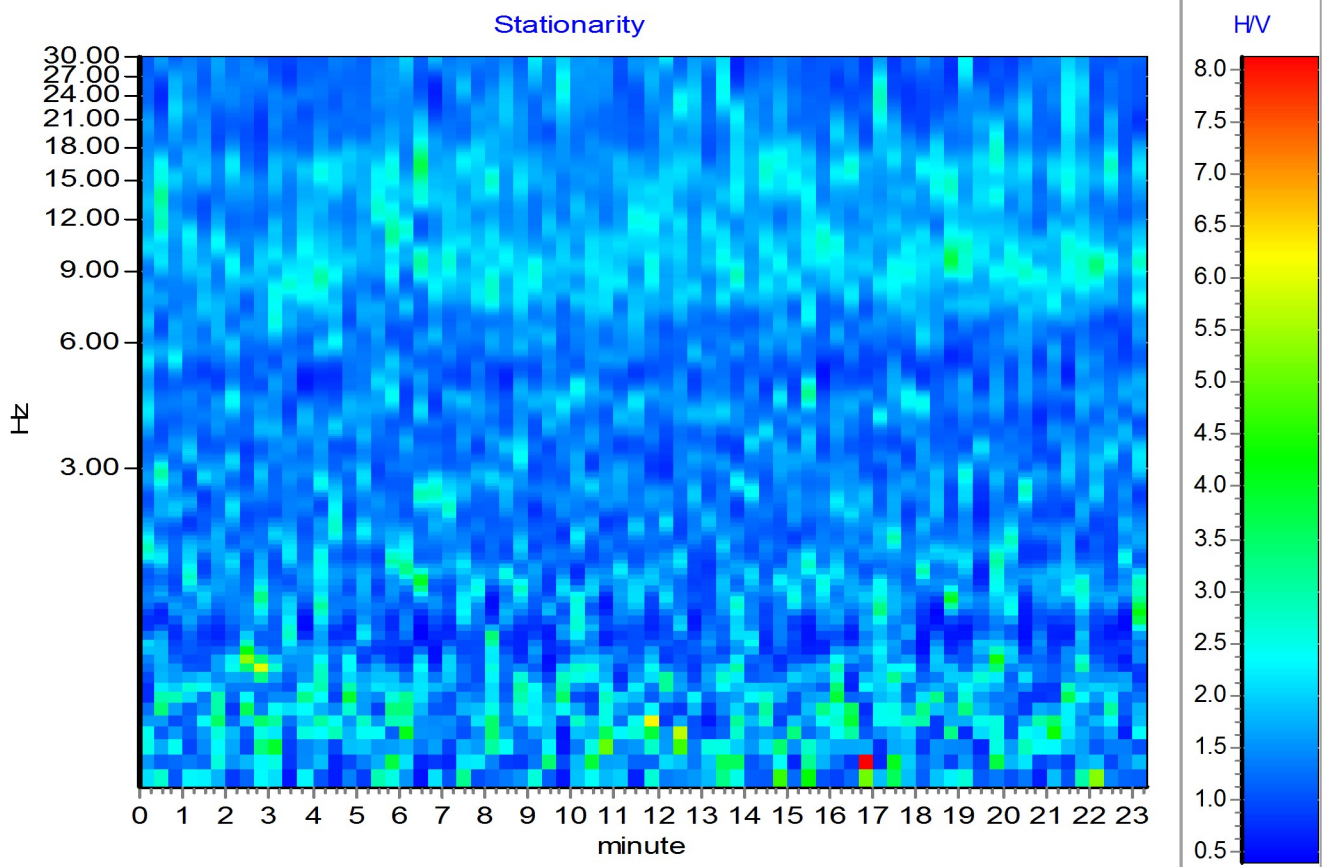
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

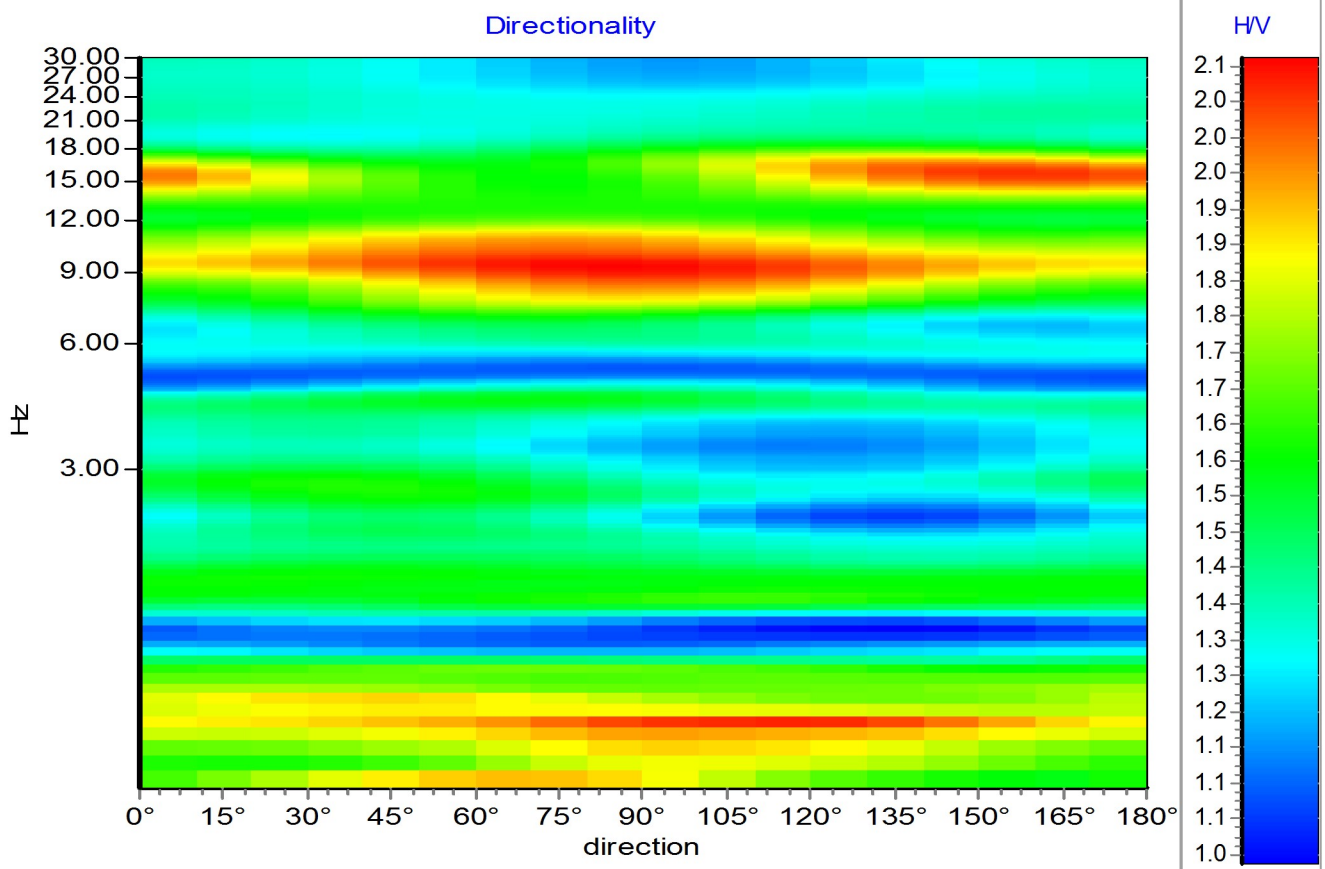
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **37 Podere Poggiarello**





Misura 38 HVRS

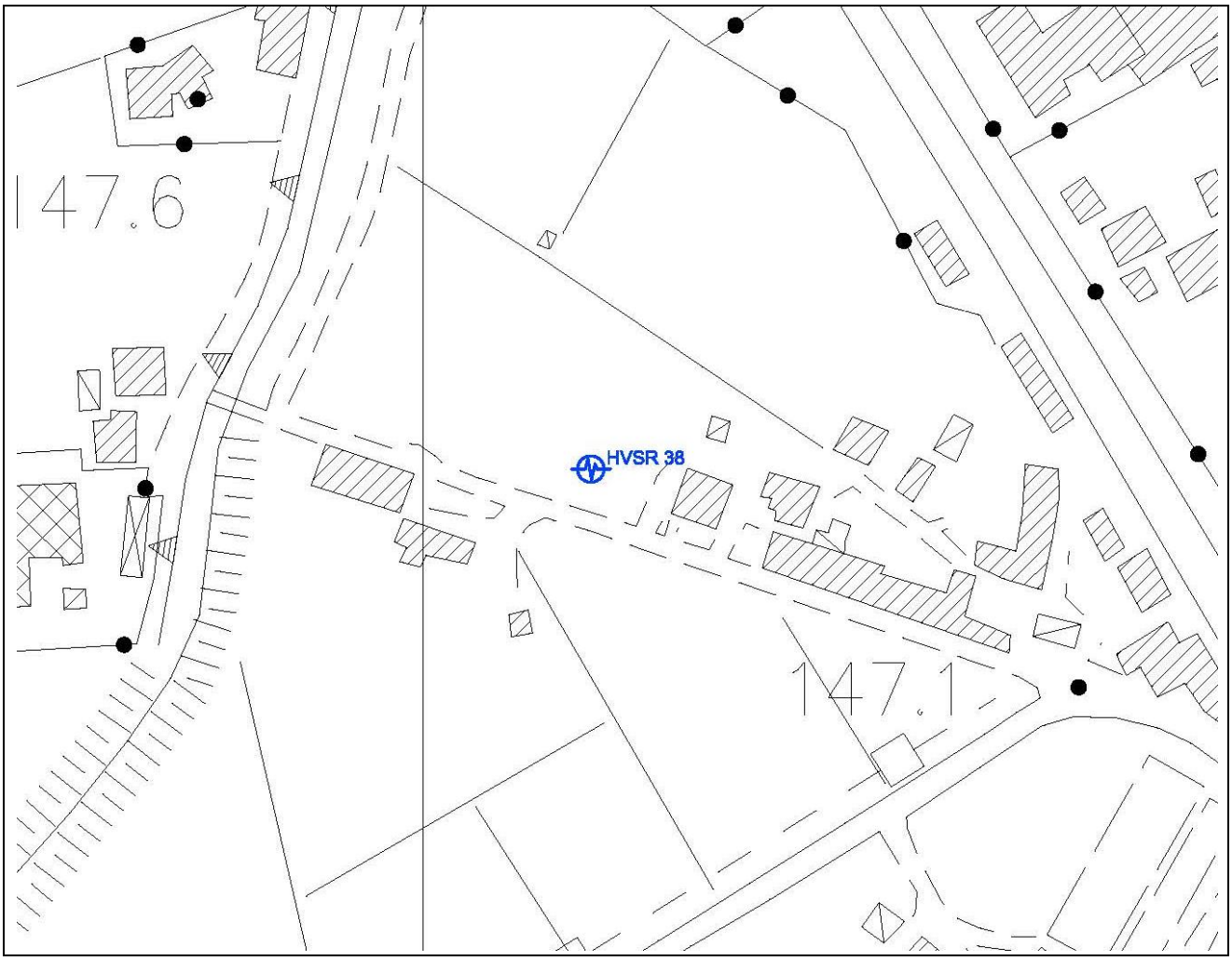


Figura 9.1 – individuazione del sito di studio - scala 1:2.000

Figura 9.2: rilievo sismico

H/V Spectral ratio

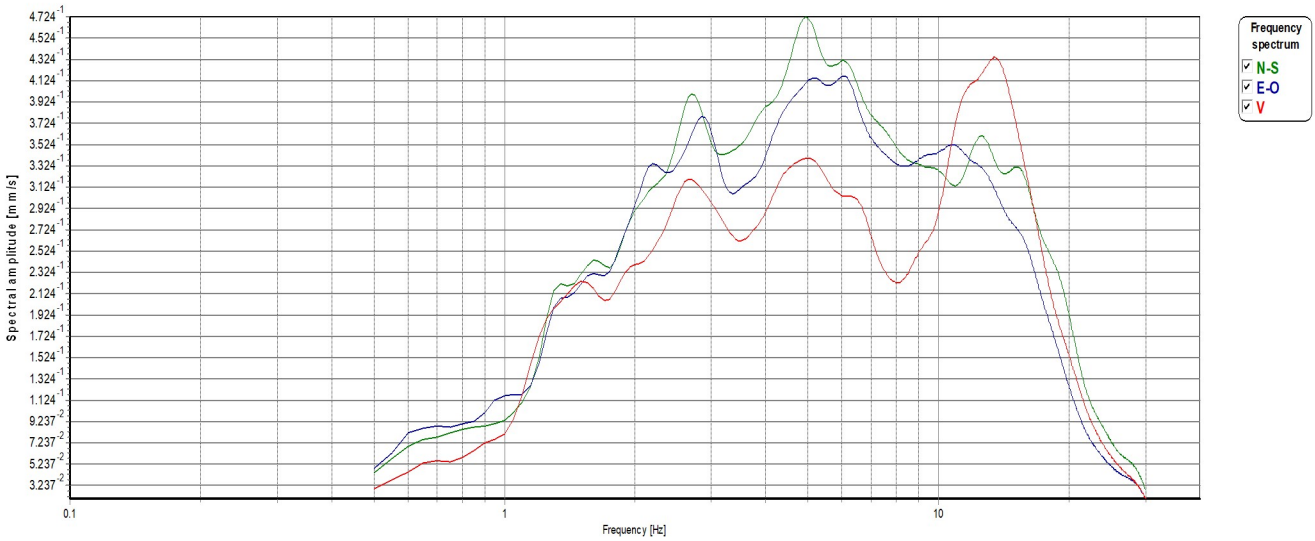
Analysis site: **Montevarchi**

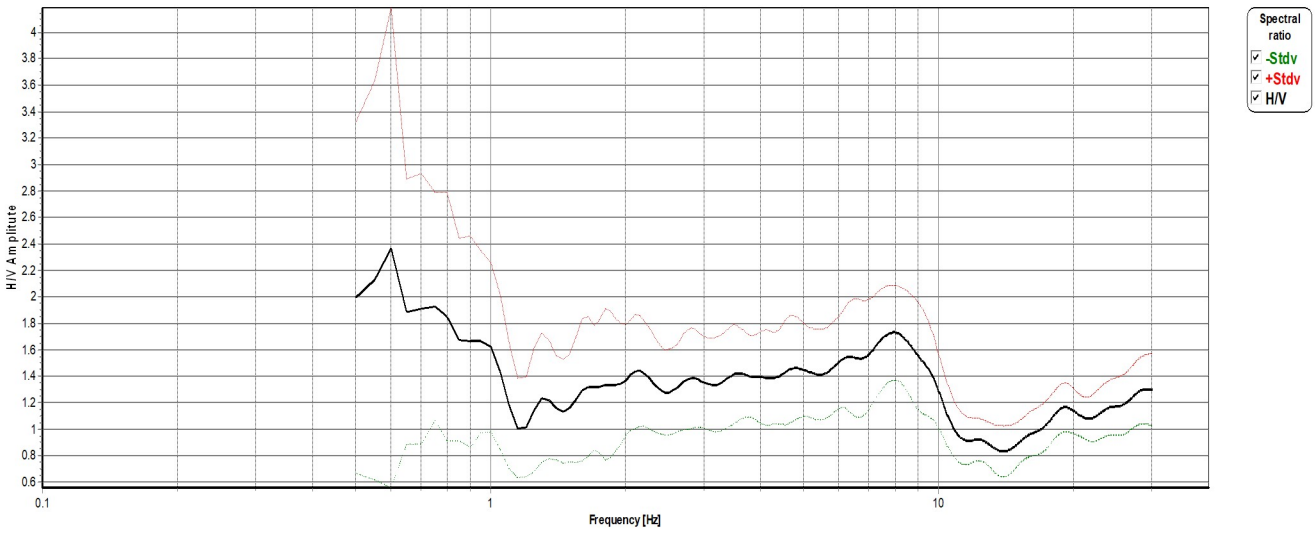
Measure point: **38 Montevarchi**

Note: Montevarchi

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**30/06/2021 09:14:45**
Automatic spike removal:	**No**	Stop recordings:	**30/06/2021 09:54:45**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**102**
Lw Windows [s]:	**20**	Recording length [s]:	**2400**
Overlap Windows s]:	**0.0**	Discarded windows:	**18**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.784**	Standard deviation [Hz]:	**0.380**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **38 Montevarchi**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.78 >= 0.50**	**Yes**
Nc(fø) > 200	**1599.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 22**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.85 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**920.64% > 5.00%**	**No**
sf < e(fø)	**0.3800 > 0.1176**	**No**
sA(fø) < ?(fø)	**0.9380 < 2.0000**	**Yes**

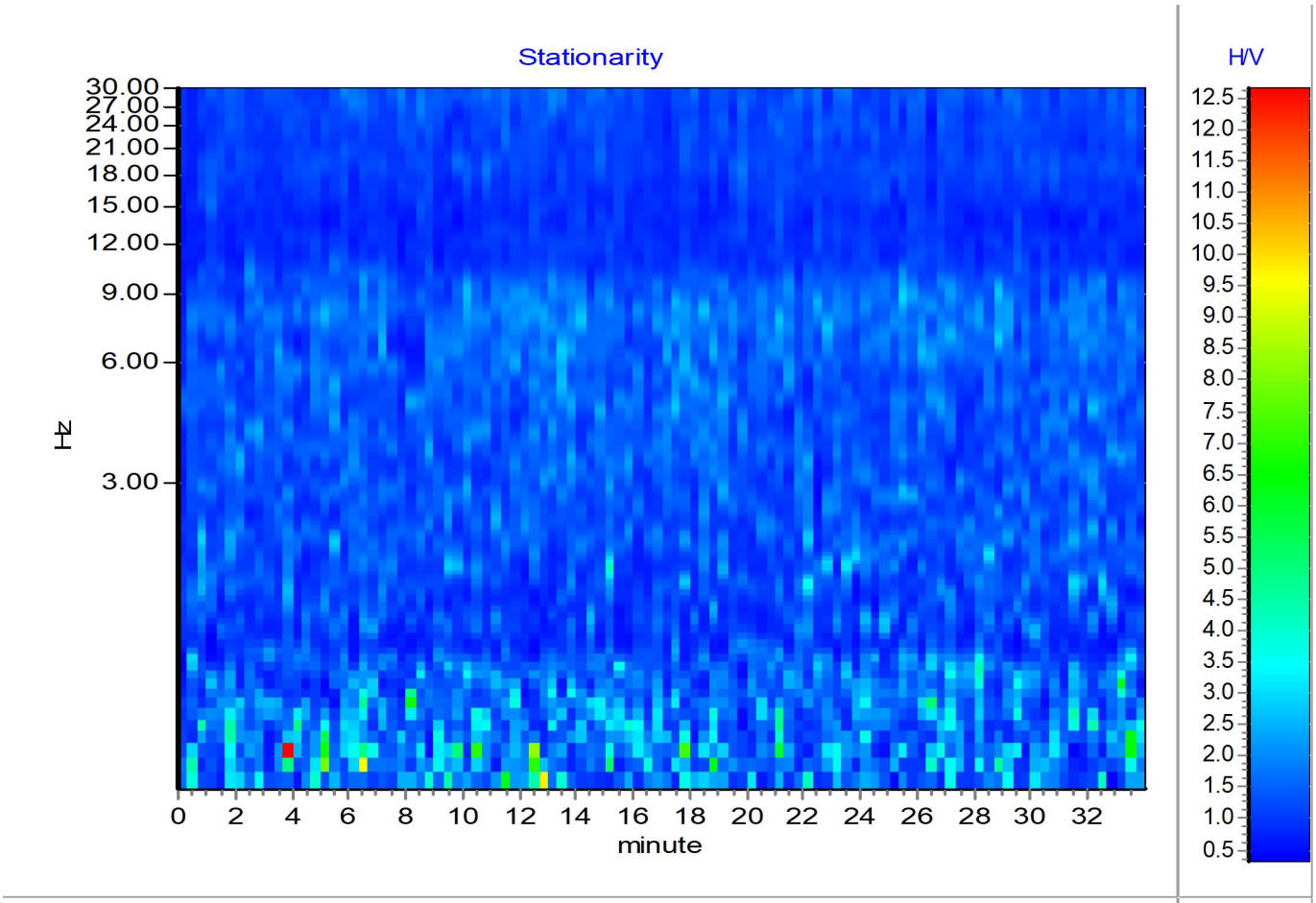
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

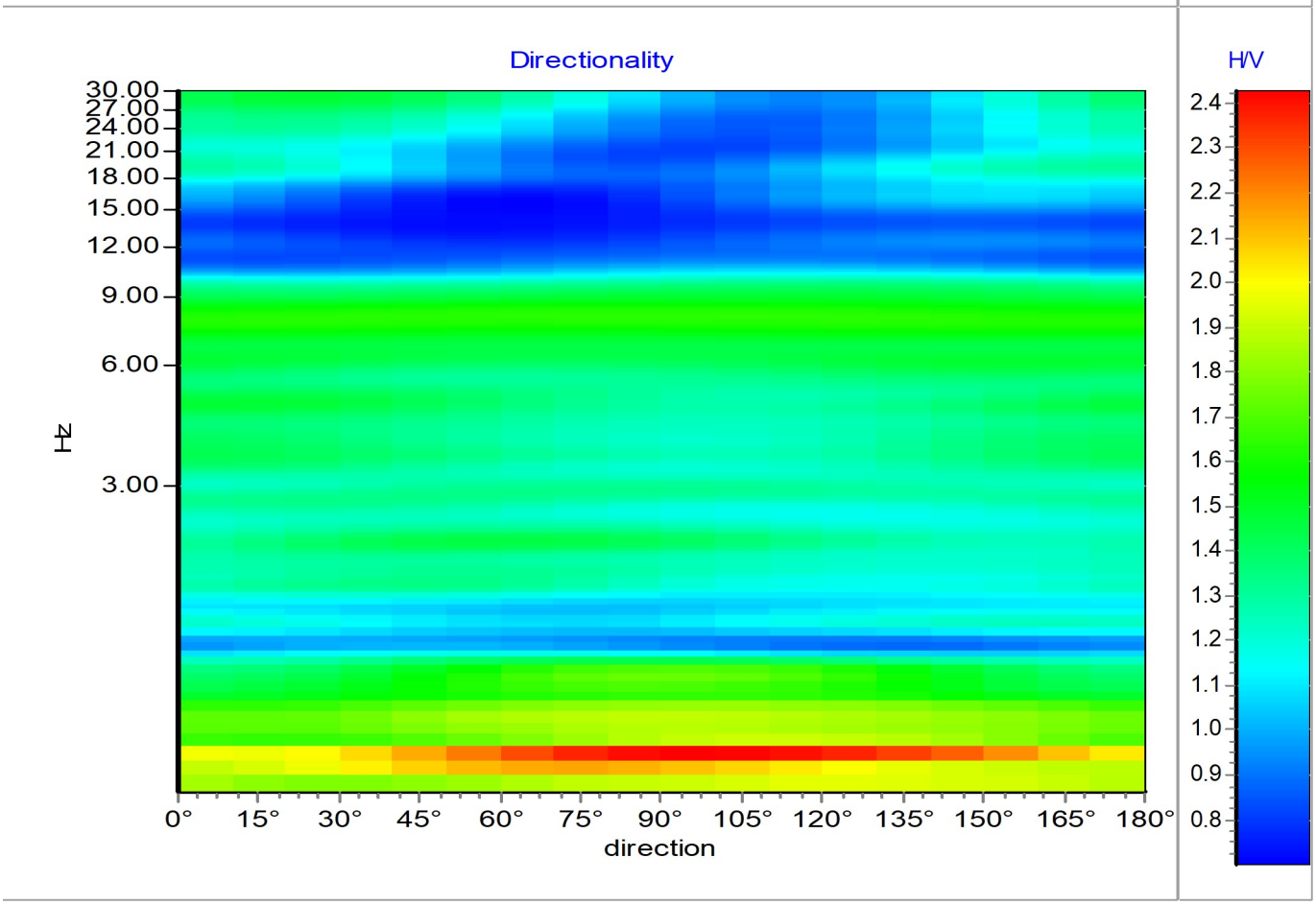
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **38 Montevarchi**





Misura 39 HVRS

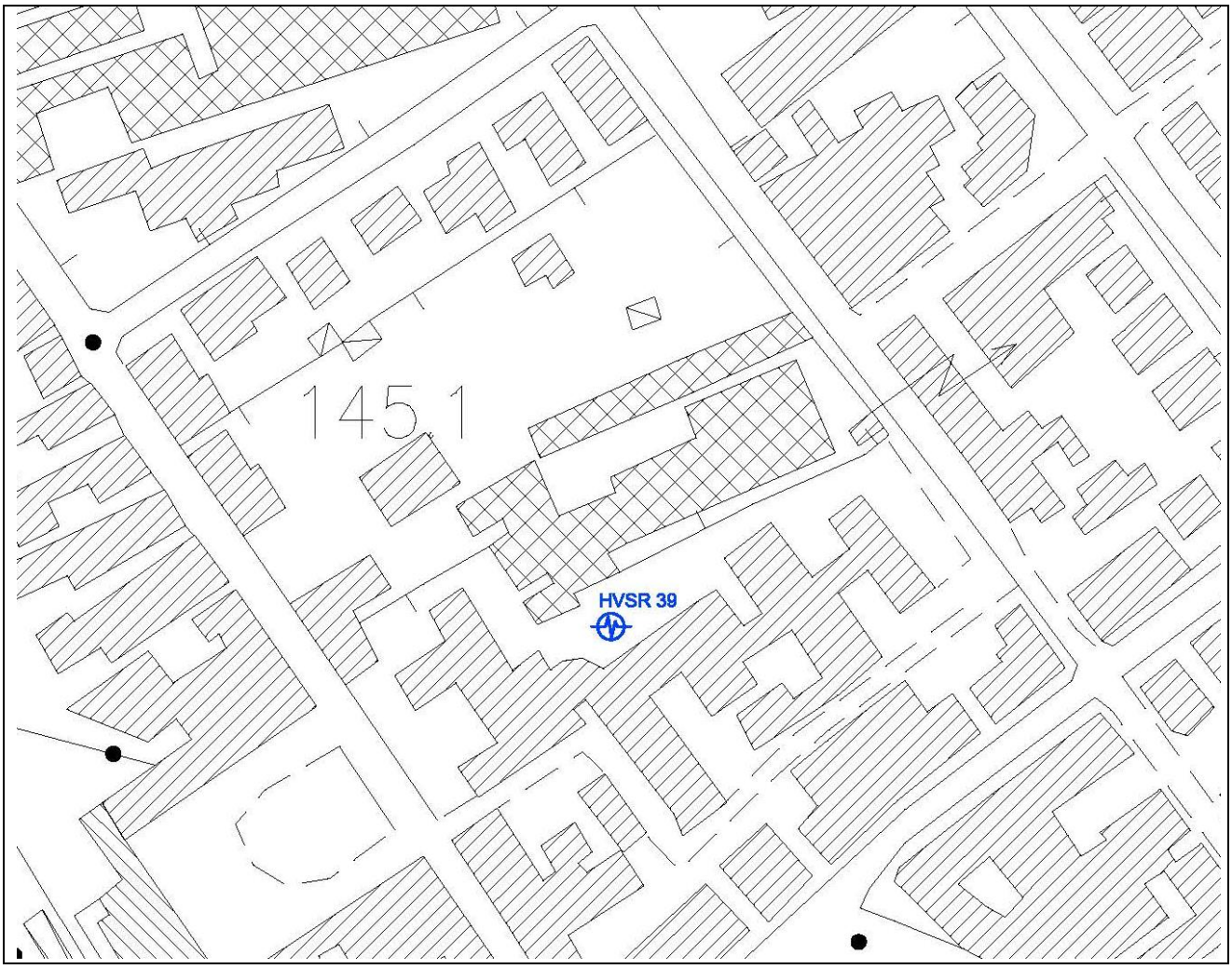


Figura 10.1 – individuazione del sito di studio - scala 1:2.000

Figura 10.2: rilievo sismico

H/V Spectral ratio

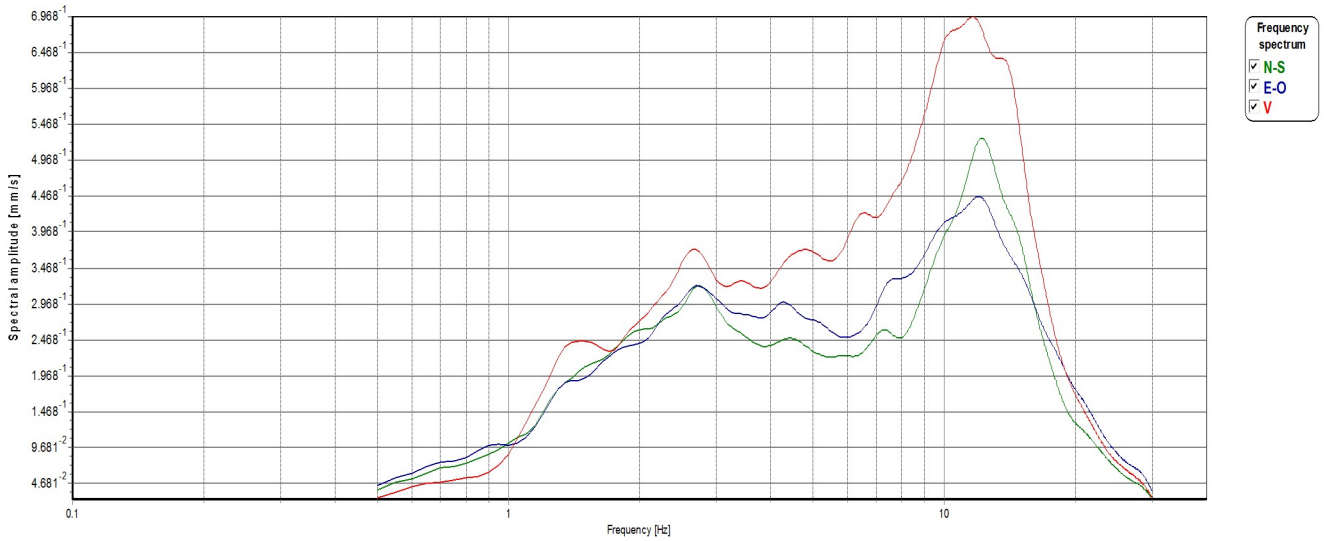
Analysis site: **Montevarchi**

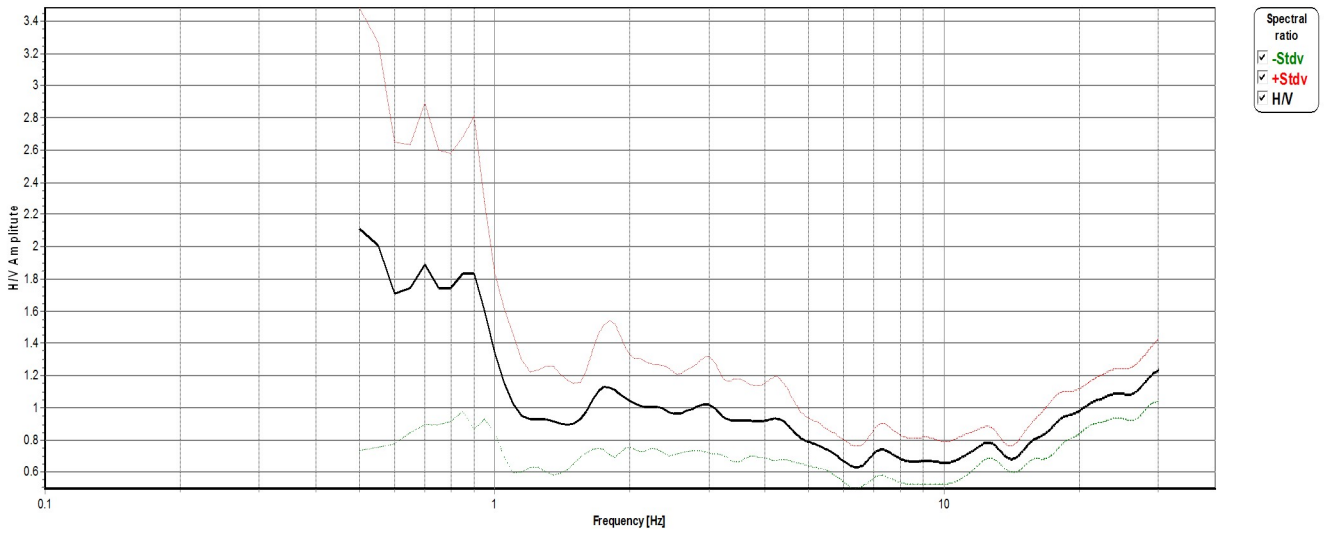
Measure point: **39 Montevarchi**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 16:24:15**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 16:59:15**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**86**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**19**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.674**	Standard deviation [Hz]:	**0.154**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **39 Montevarchi**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.67 >= 0.50**	**Yes**
Nc(fø) > 200	**1160.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 17**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**Not exist**	**No**
Aø > 2	**1.74 < 2.00**	**No**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**4348.30% > 5.00%**	**No**
sf < e(fø)	**0.1540 > 0.1012**	**No**
sA(fø) < ?(fø)	**0.8910 < 2.0000**	**Yes**

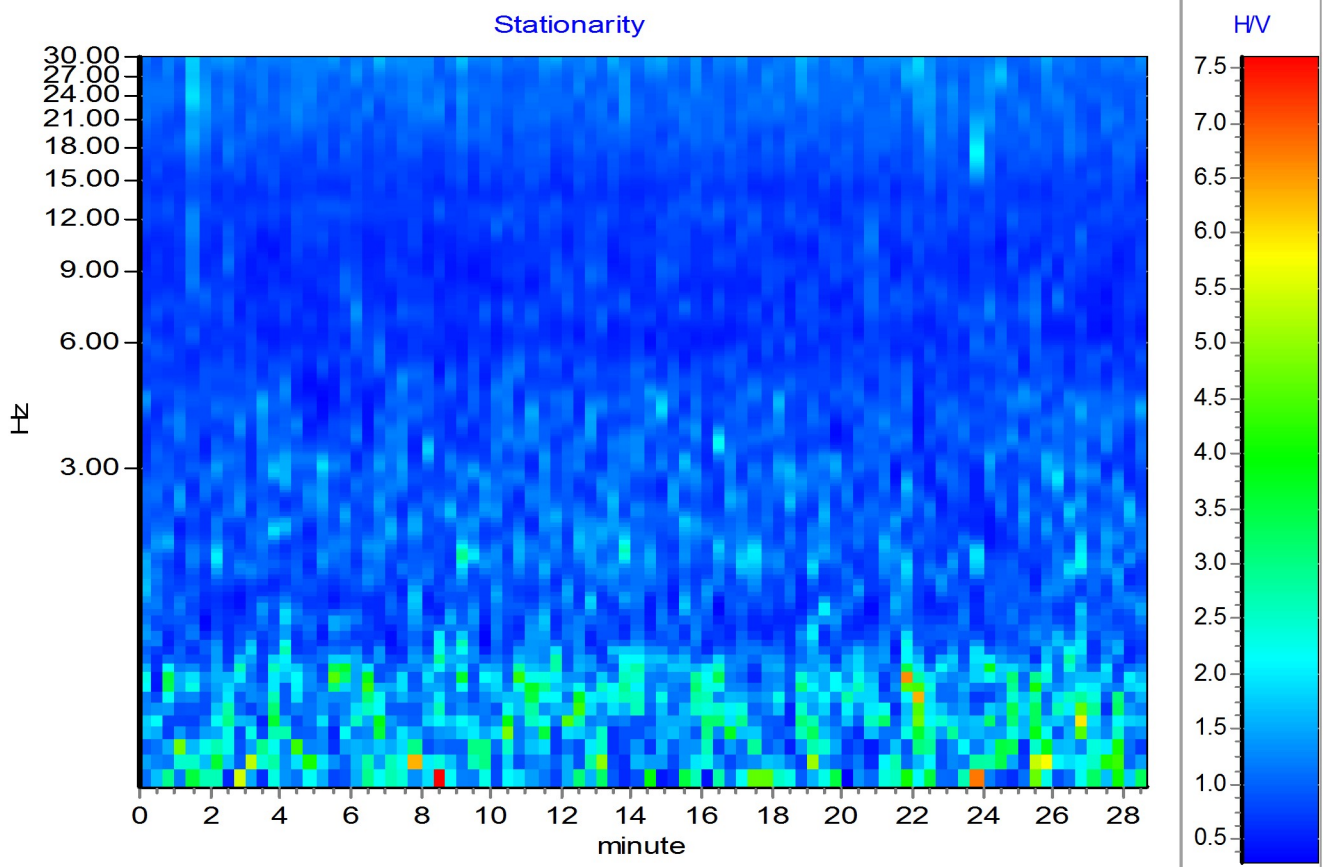
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

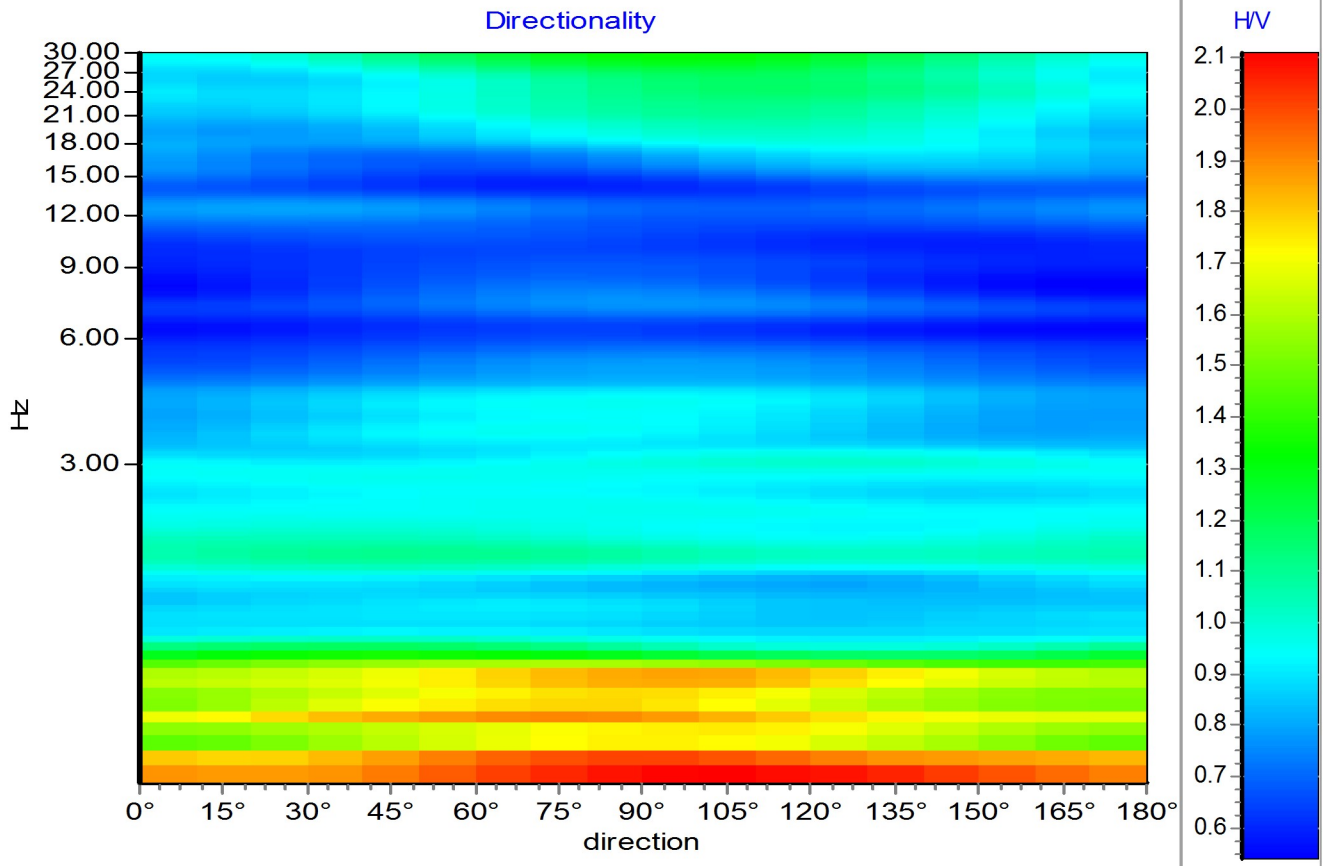
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **39 Montevarchi**





Misura 40 HVRS

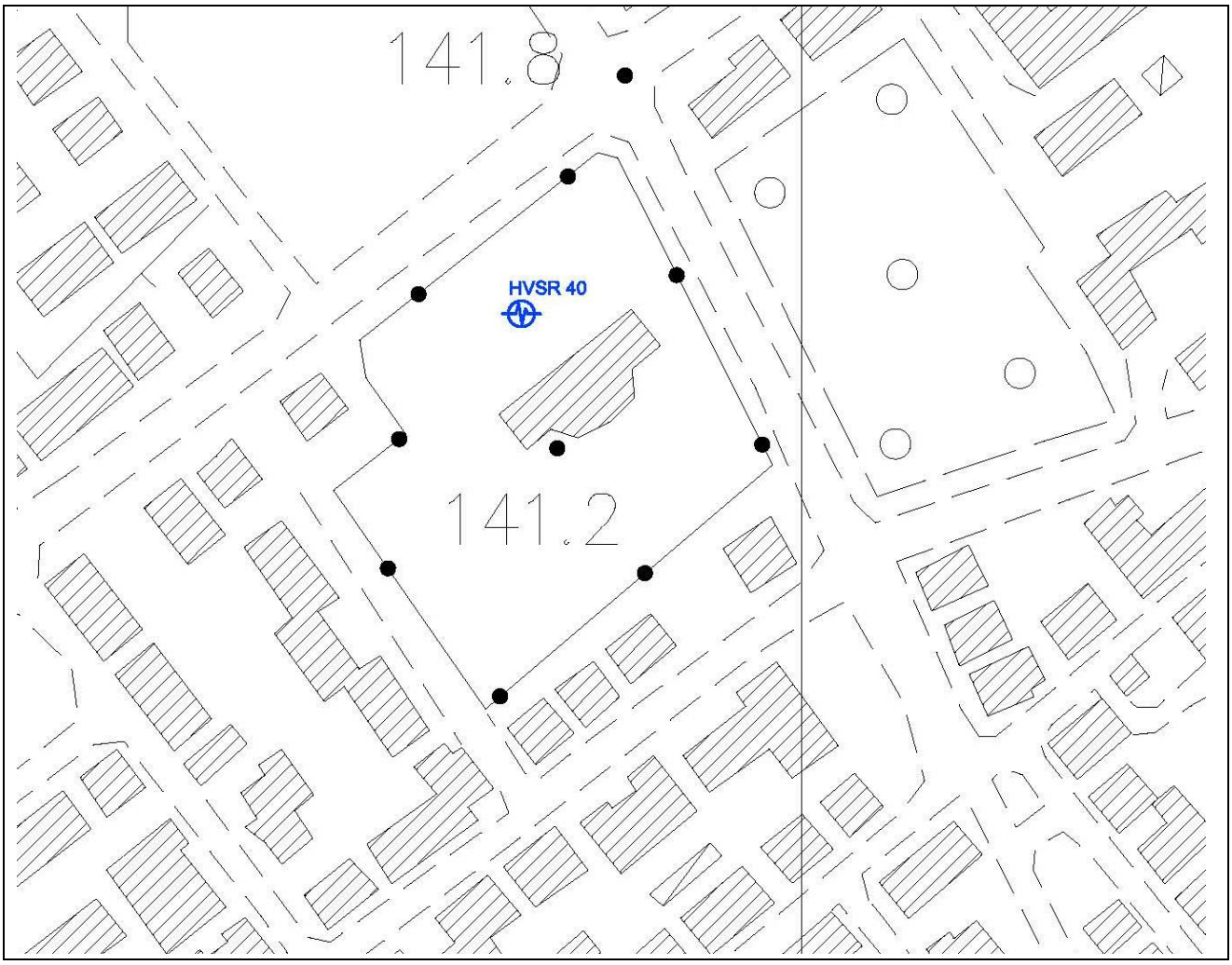


Figura 11.1 – individuazione del sito di studio - scala 1:2.000

Figura 11.2: rilievo sismico

H/V Spectral ratio

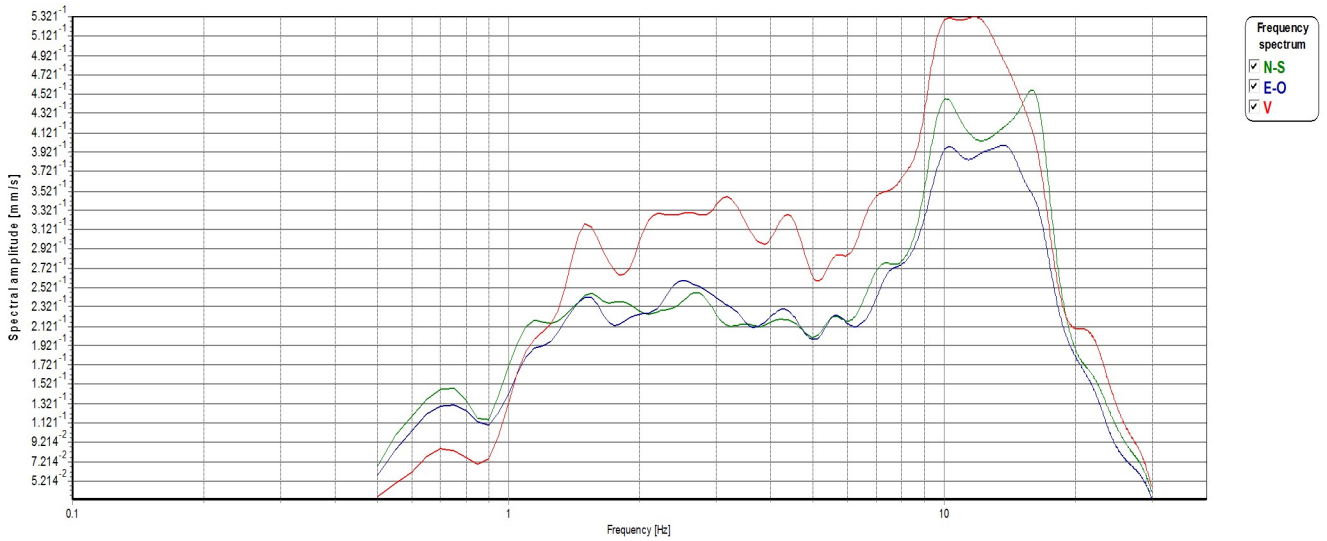
Analysis site: **Montevarchi**

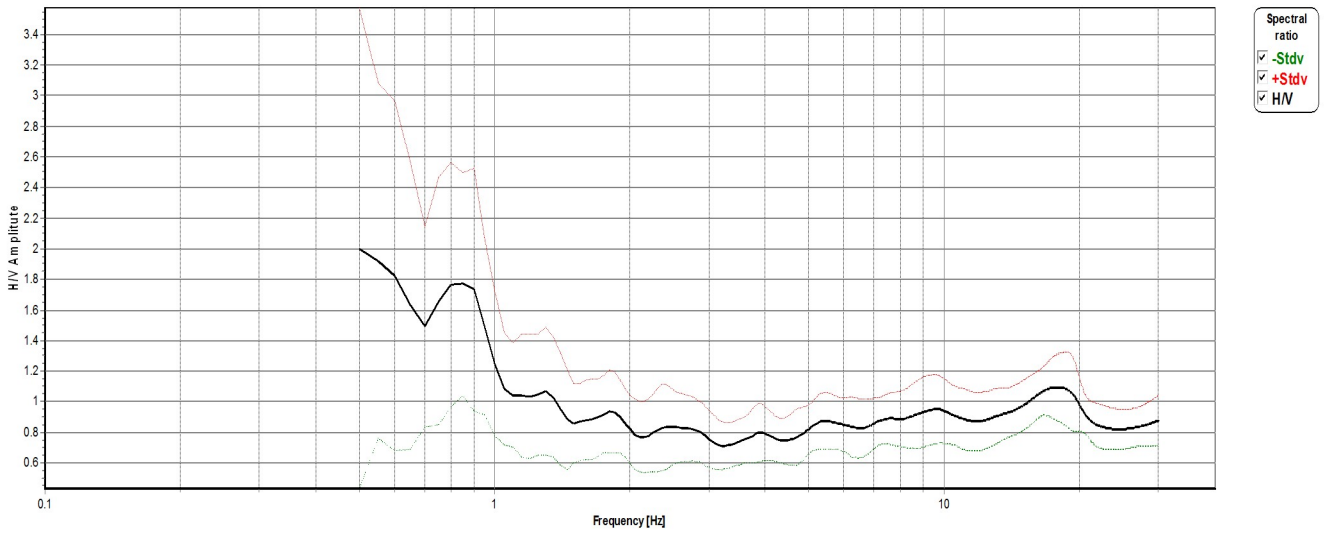
Measure point: **40 La Steccata**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 15:36:09**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 16:06:09**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**82**
Lw Windows [s]:	**20**	Recording length [s]:	**1800**
Overlap Windows s]:	**0.0**	Discarded windows:	**8**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.673**	Standard deviation [Hz]:	**0.148**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **40 La Steccata**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.67 >= 0.50**	**Yes**
Nc(fø) > 200	**1104.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 17**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.050**	**Yes**
Aø > 2	**1.63 < 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**26.27% > 5.00%**	**No**
sf < e(fø)	**0.1476 > 0.1010**	**No**
sA(fø) < ?(fø)	**0.9399 < 2.0000**	**Yes**

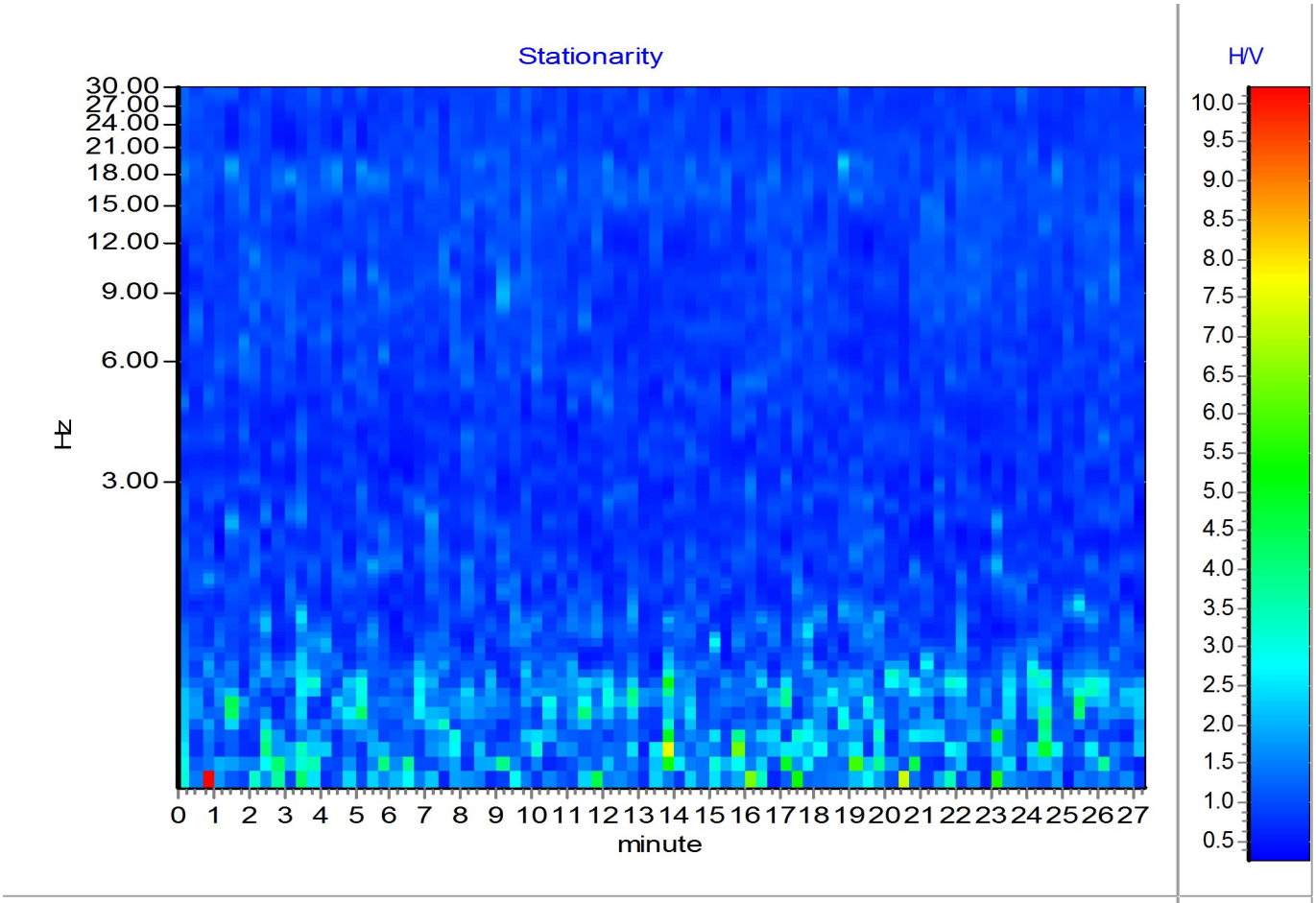
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

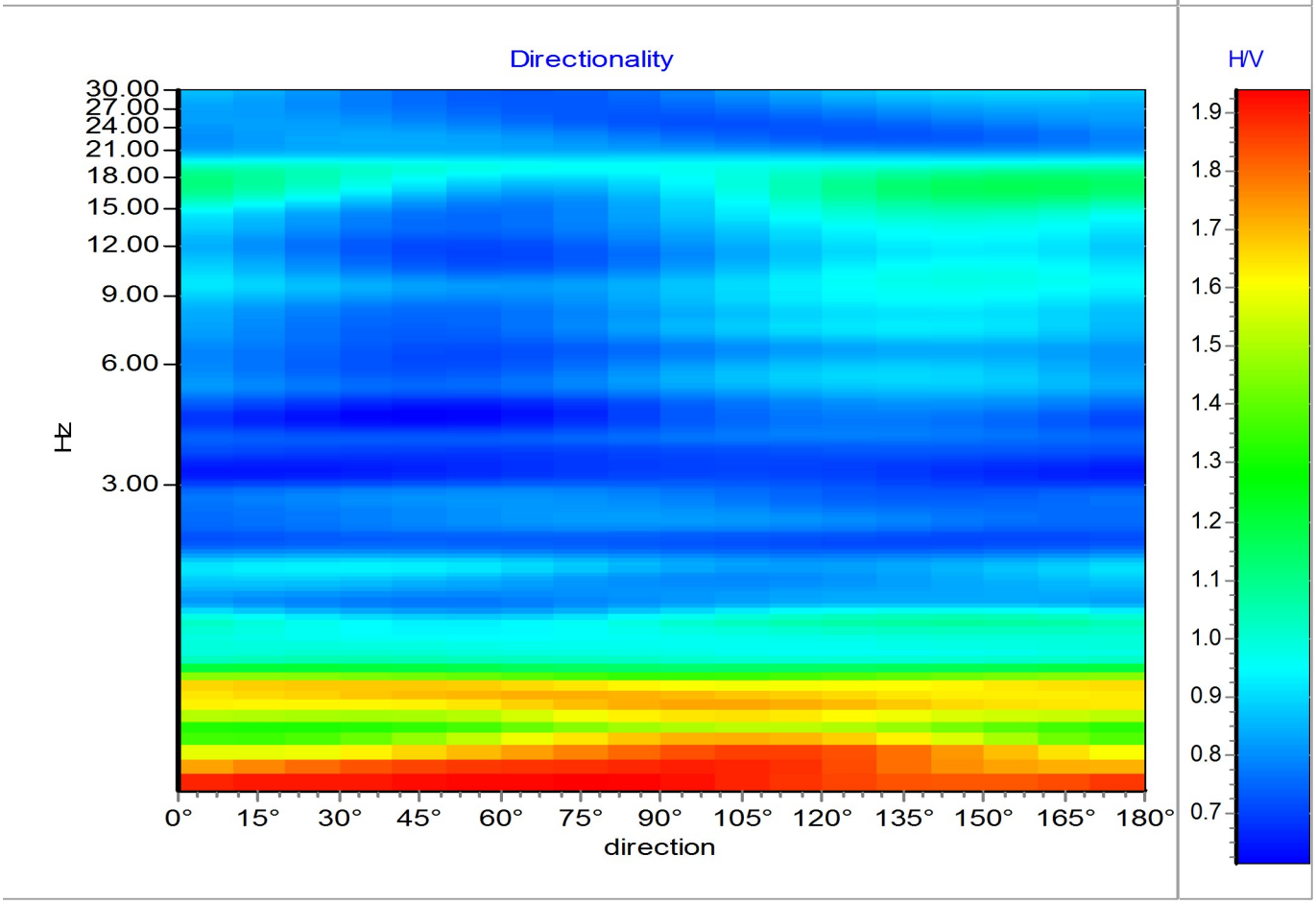
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **40 La Steccata**





Misura 41 HVRS

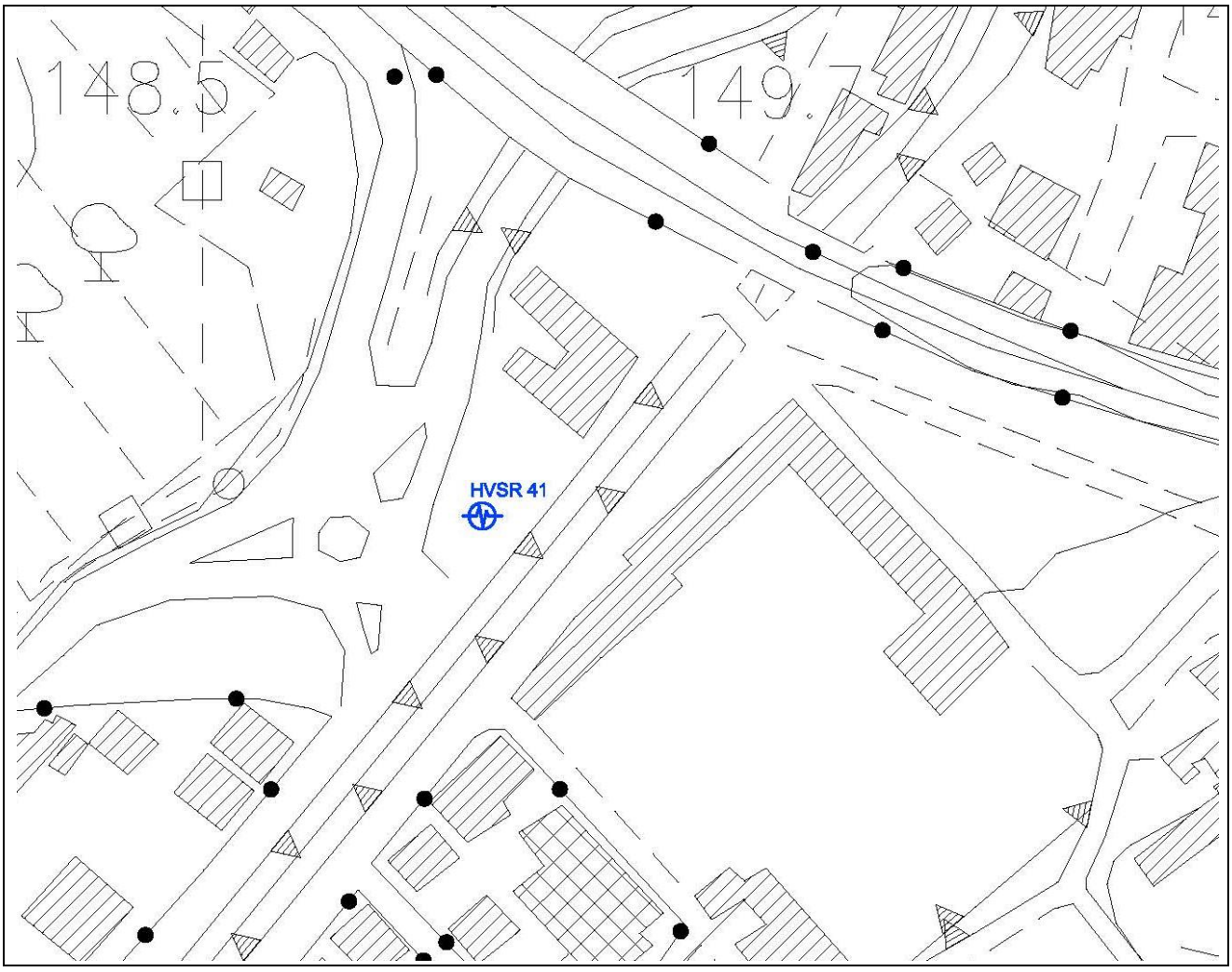


Figura 12.1 – individuazione del sito di studio - scala 1:2.000

Figura 12.2: rilievo sismico

H/V Spectral ratio

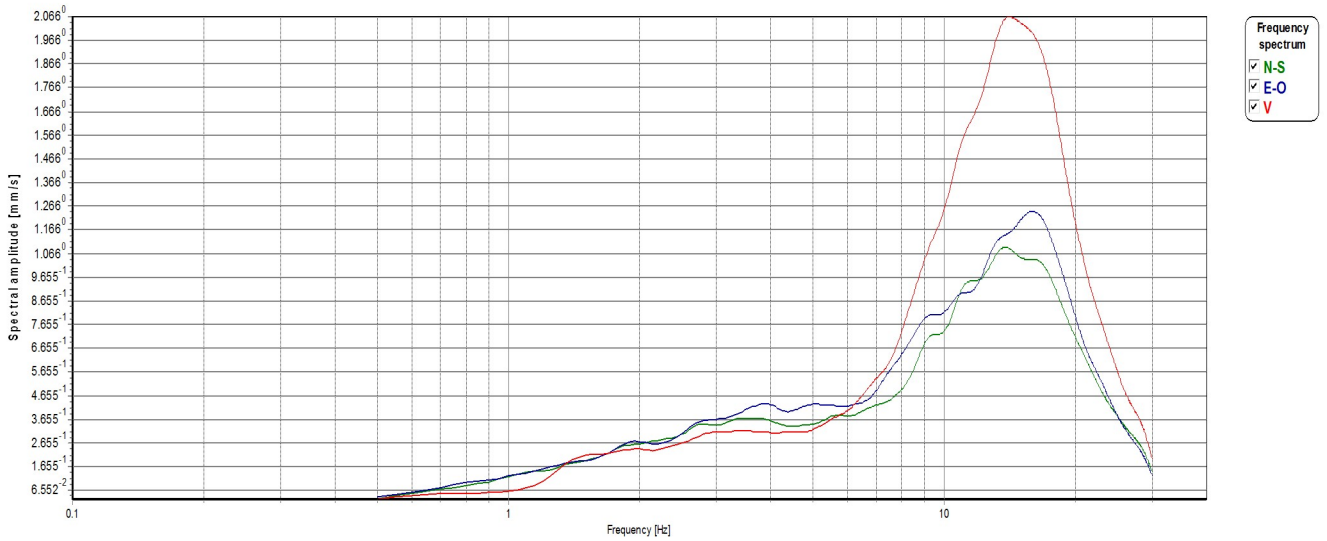
Analysis site: **Montevarchi**

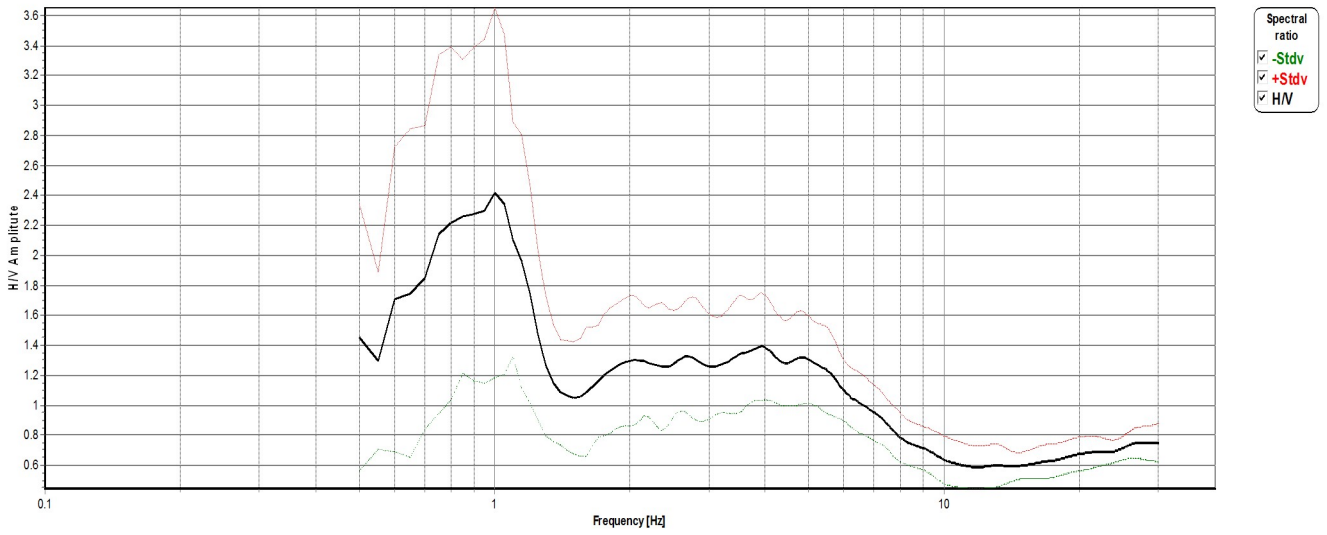
Measure point: **41 Rotonda**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 16:23:04**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 16:58:04**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**81**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**24**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.877**	Standard deviation [Hz]:	**0.177**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **41 Rotonda**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.88 >= 0.50**	**Yes**
Nc(fø) > 200	**1421.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 26**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.400**	**Yes**
Aø > 2	**2.27 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**25.40% > 5.00%**	**No**
sf < e(fø)	**0.1774 > 0.1316**	**No**
sA(fø) < ?(fø)	**1.1144 < 2.0000**	**Yes**

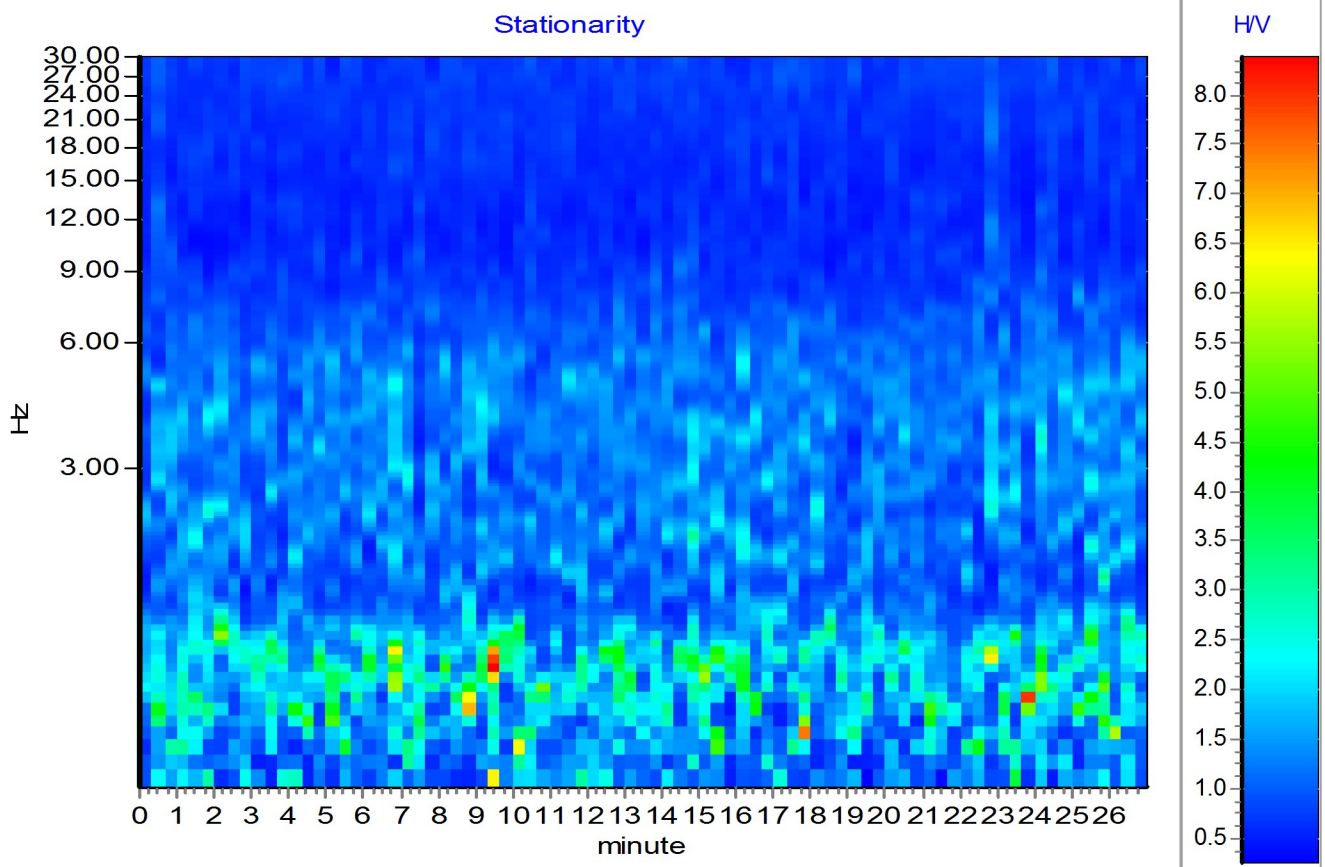
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

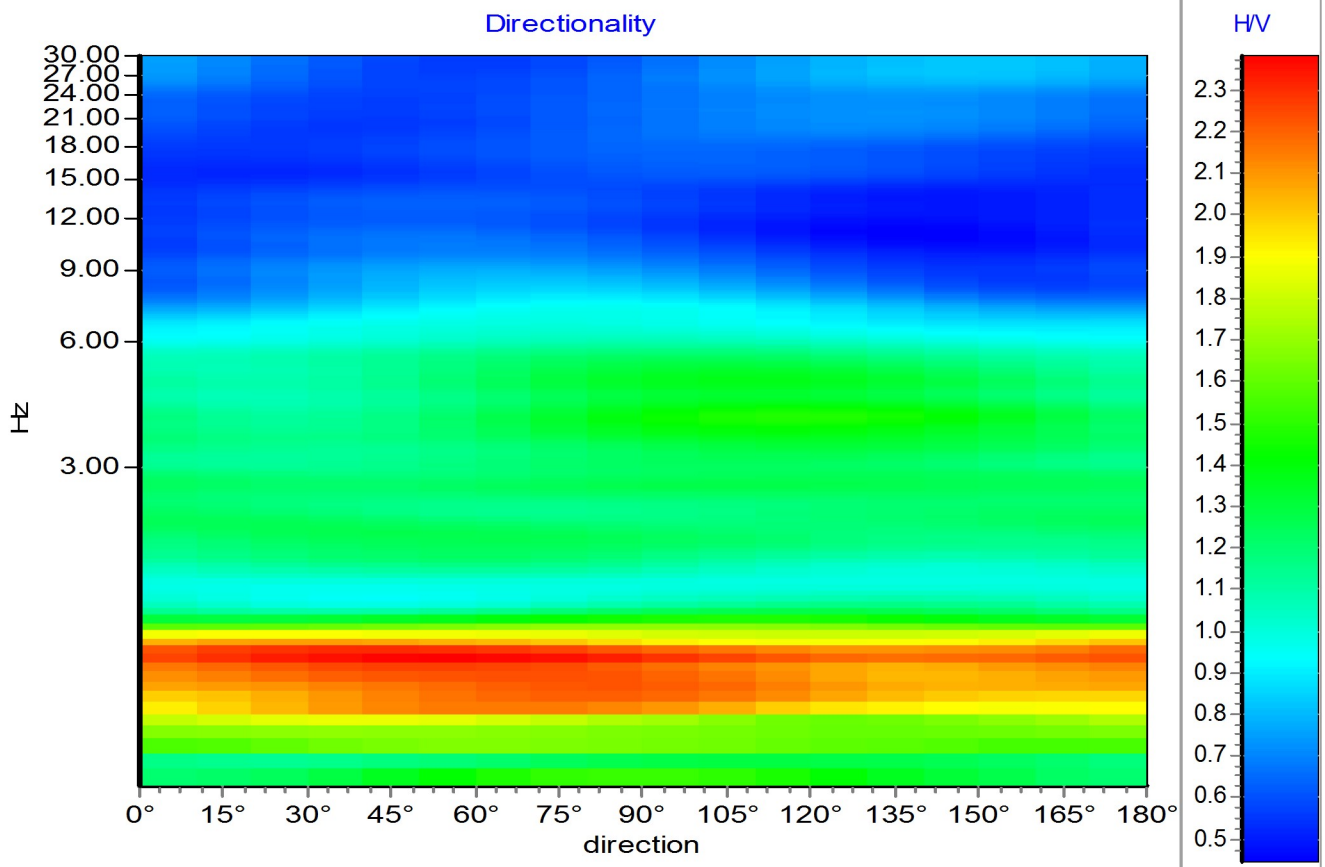
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **41 Rotonda**





Misura 42 HVRS

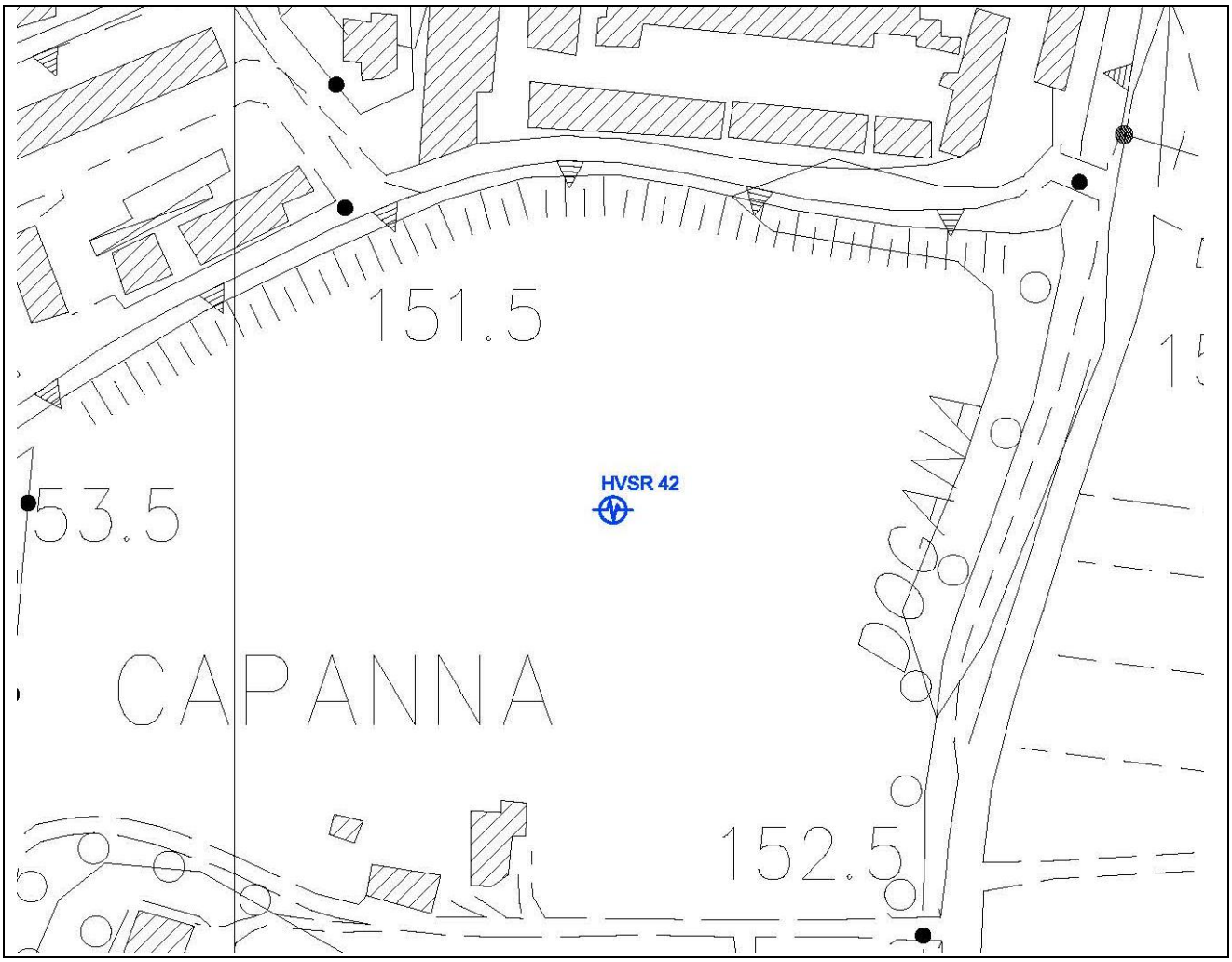


Figura 13.1 – individuazione del sito di studio - scala 1:2.000

Figura 13.2: rilievo sismico

H/V Spectral ratio

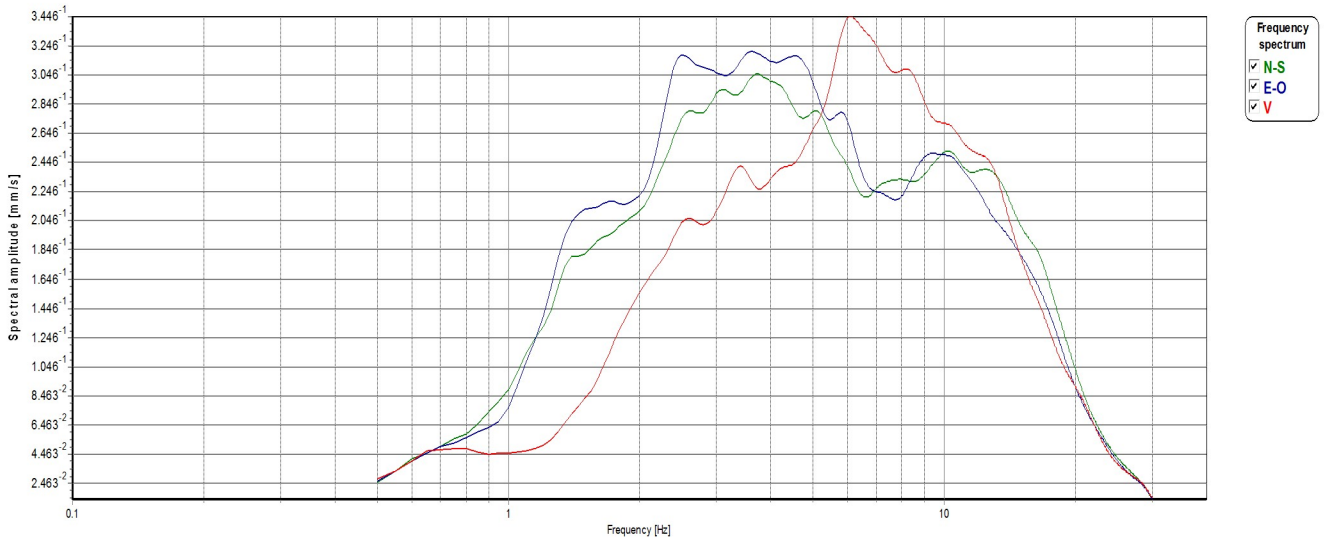
Analysis site: **Montevarchi**

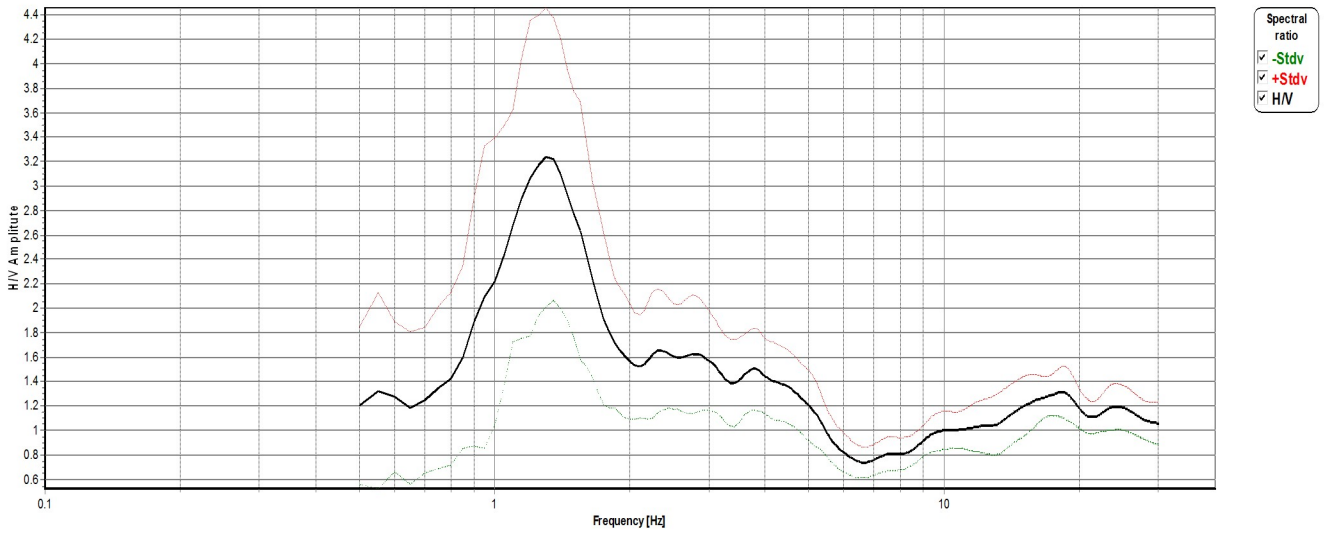
Measure point: **42 Capanna**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 17:17:01**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 17:52:01**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**91**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**14**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.249**	Standard deviation [Hz]:	**0.185**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **42 Capanna**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.25 >= 0.50**	**Yes**
Nc(fø) > 200	**2274.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 37**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.000**	**Yes**
Aø > 2	**3.17 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**8.05% > 5.00%**	**No**
sf < e(fø)	**0.1846 > 0.1249**	**No**
sA(fø) < ?(fø)	**1.2275 < 1.7800**	**Yes**

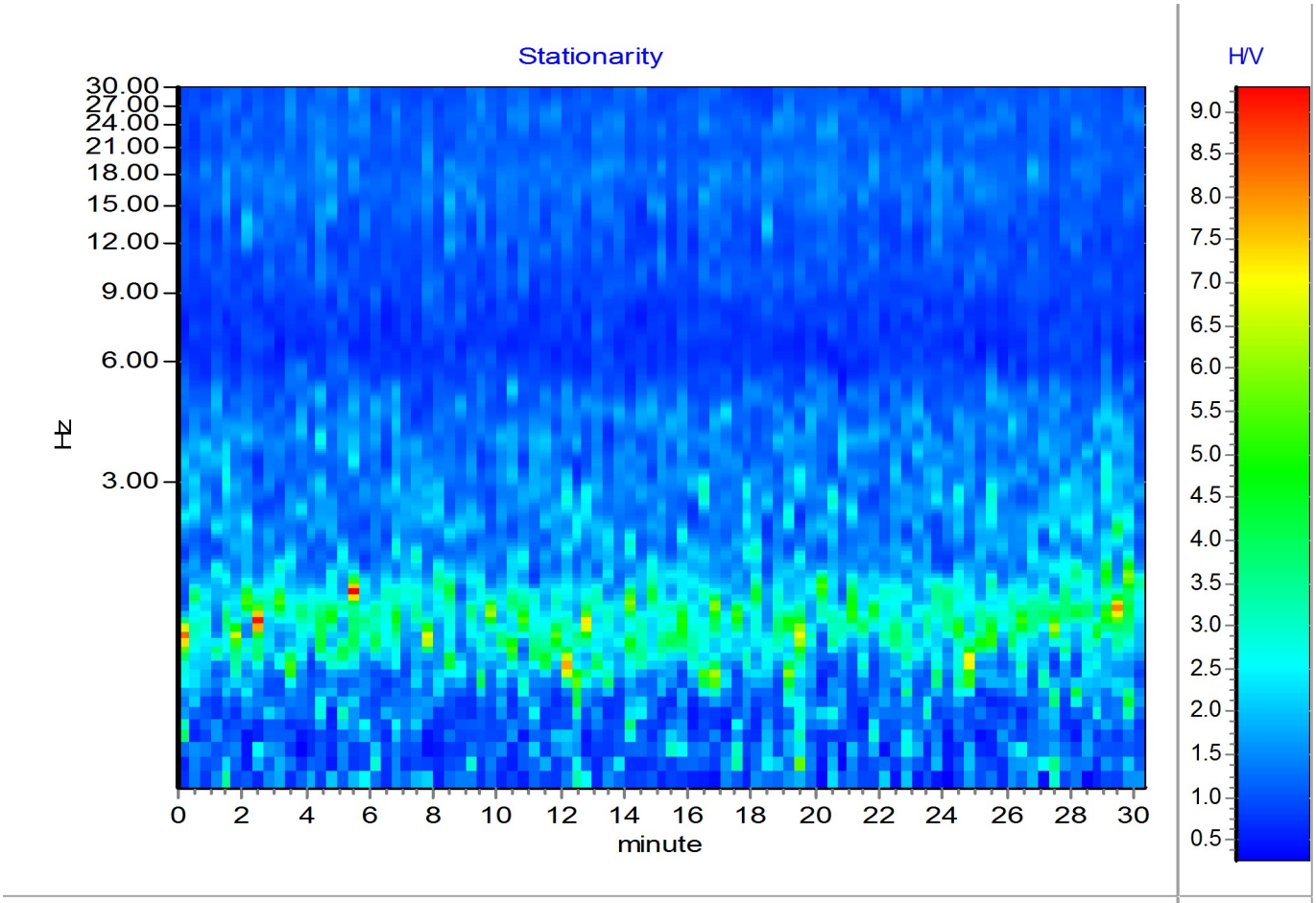
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

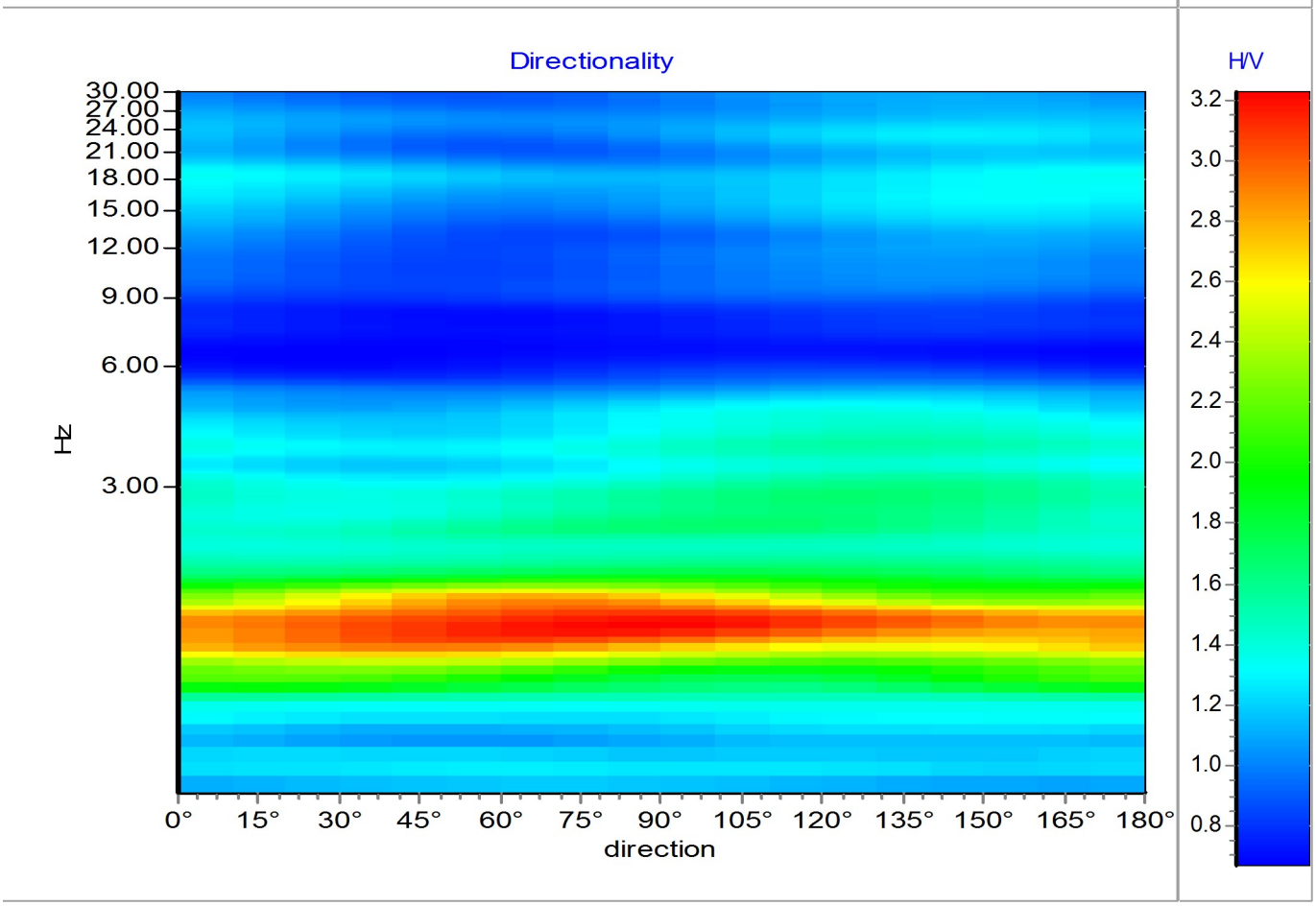
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **42 Capanna**





Misura 43 HVRS

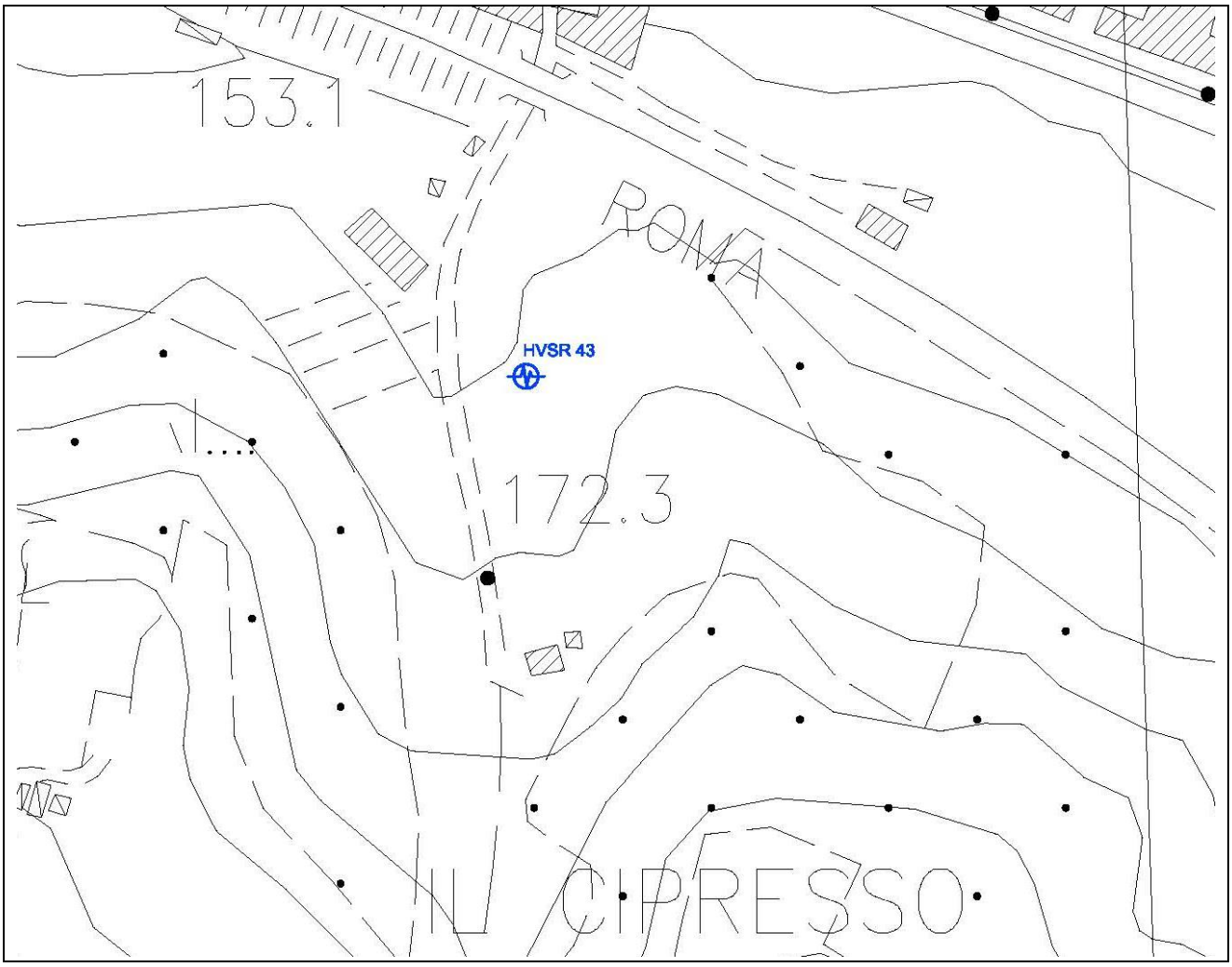


Figura 14.1 – individuazione del sito di studio - scala 1:2.000

Figura 14.2: rilievo sismico

H/V Spectral ratio

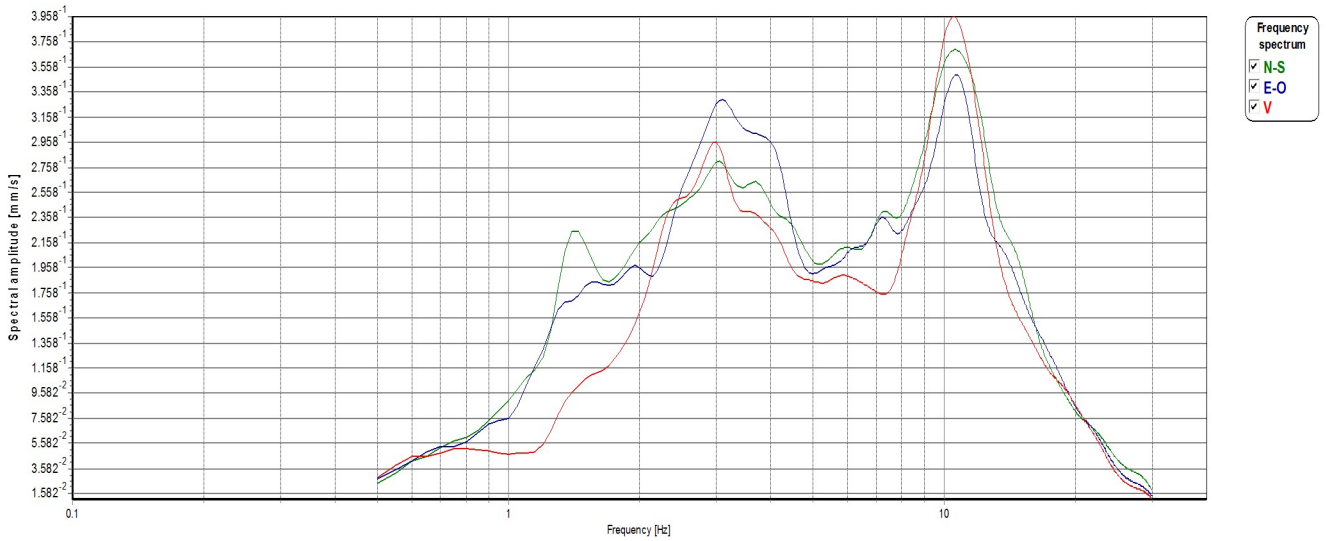
Analysis site: **Montevarchi**

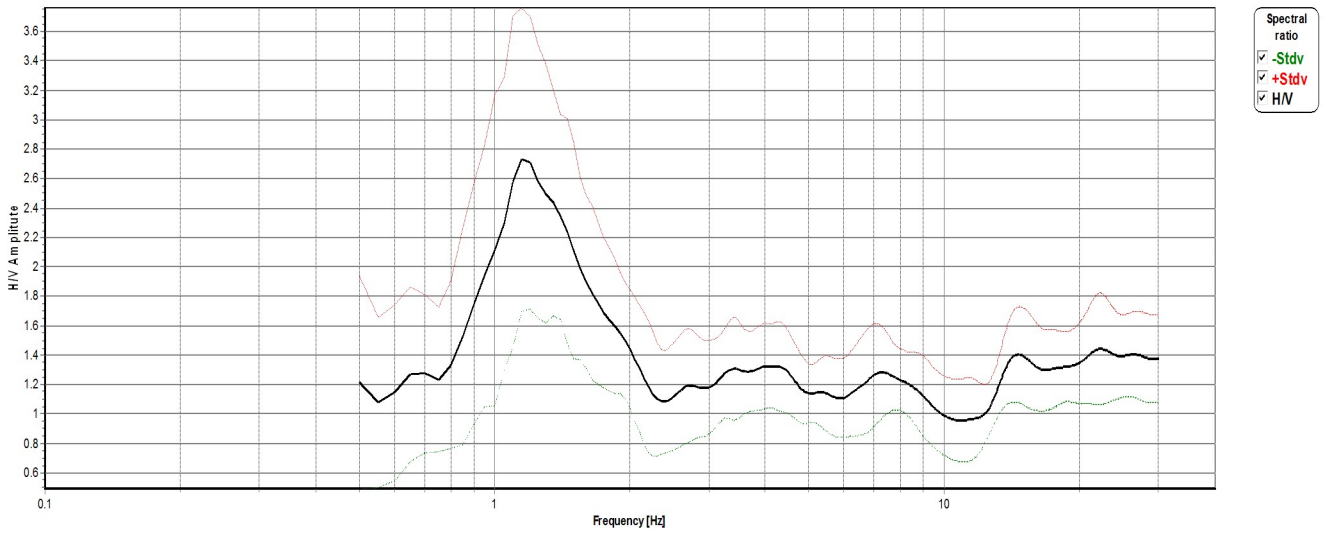
Measure point: **43 Tre Case**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 15:35:24**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 16:10:24**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**77**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**28**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.186**	Standard deviation [Hz]:	**0.166**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **43 Tre Case**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.19 >= 0.50**	**Yes**
Nc(fø) > 200	**1827.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 36**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.100**	**Yes**
Aø > 2	**2.71 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**3.07% < 5.00%**	**Yes**
sf < e(fø)	**0.1664 > 0.1186**	**No**
sA(fø) < ?(fø)	**0.9937 < 1.7800**	**Yes**

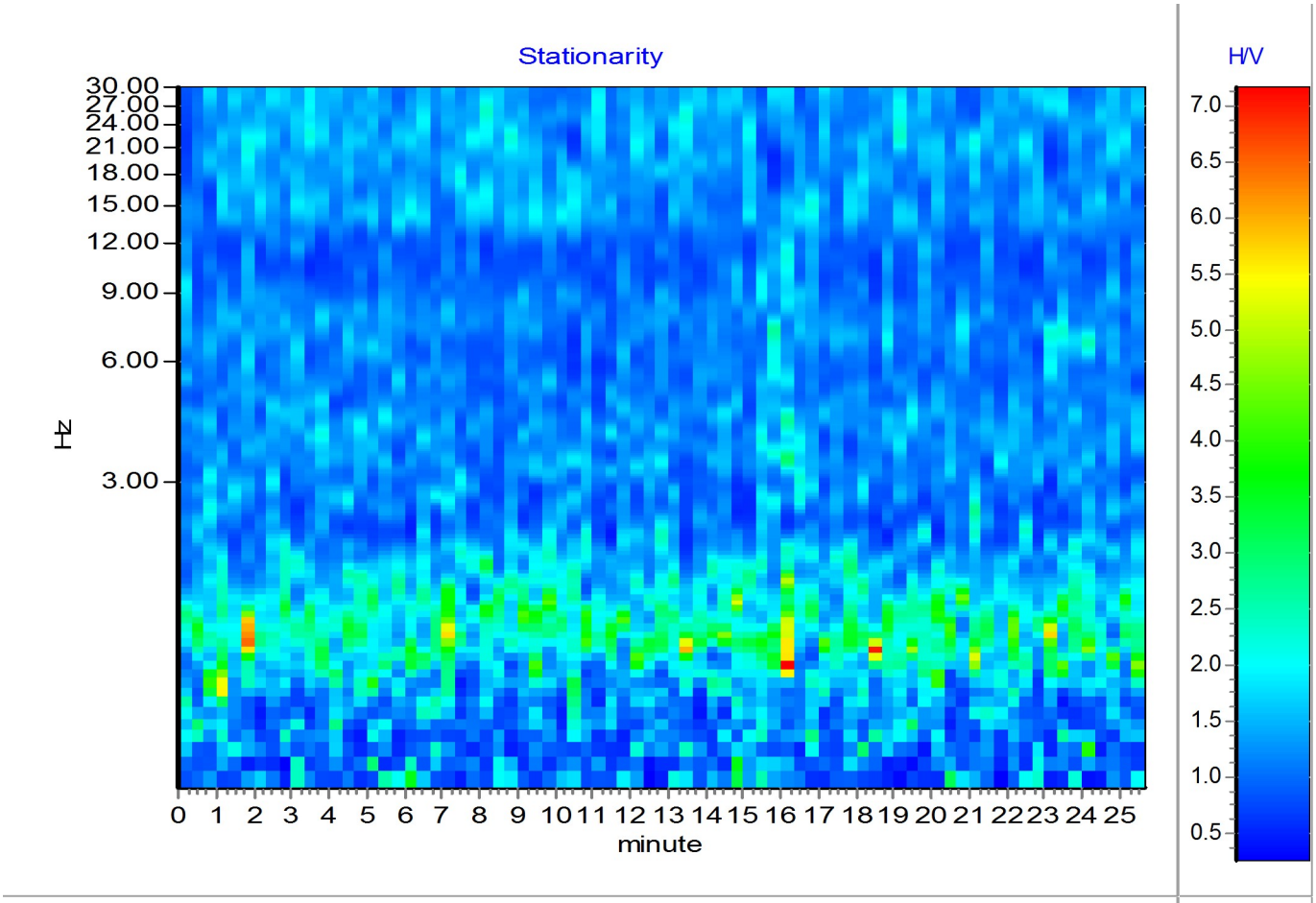
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

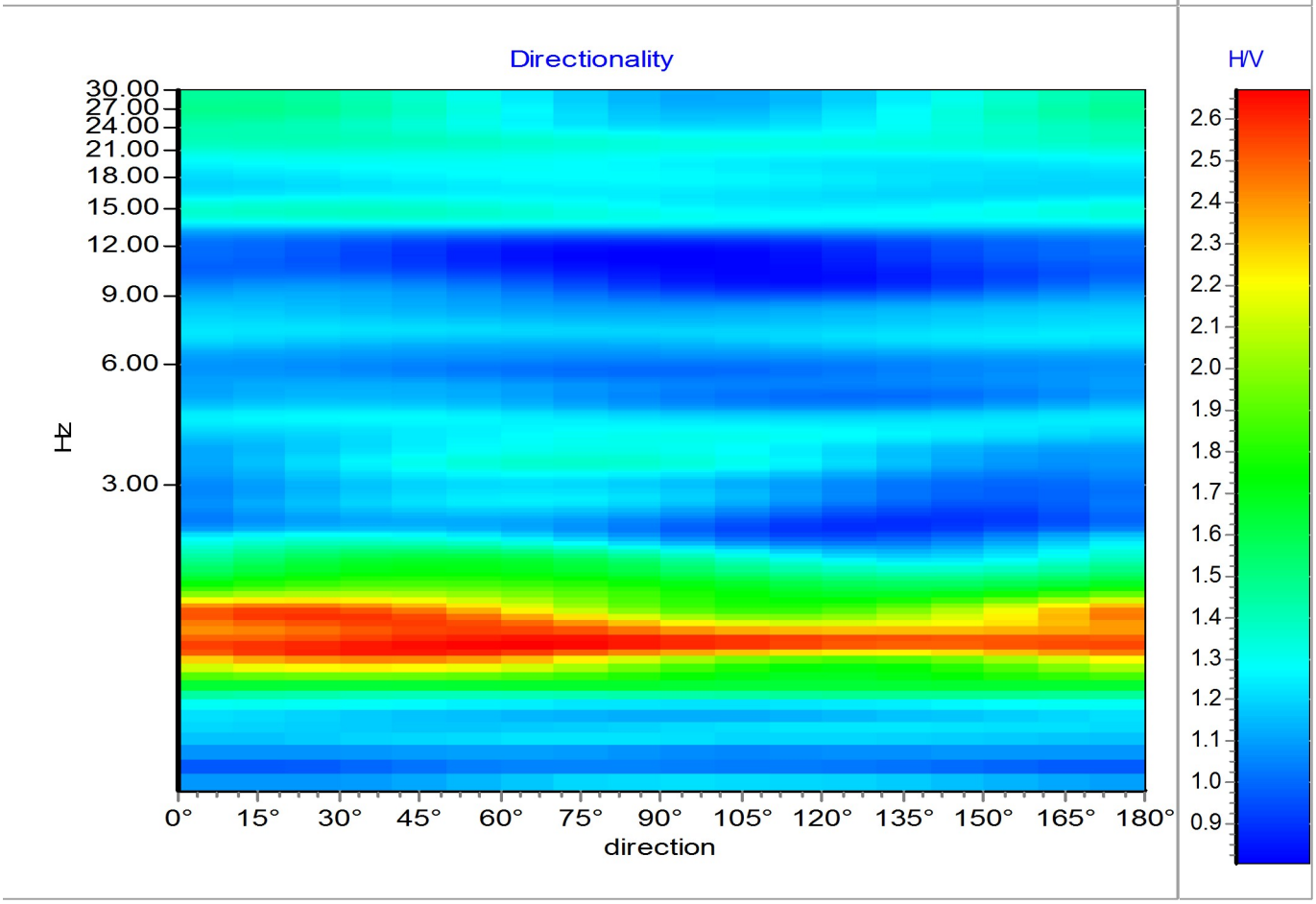
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **43 Tre Case**





Misura 44 HVRS

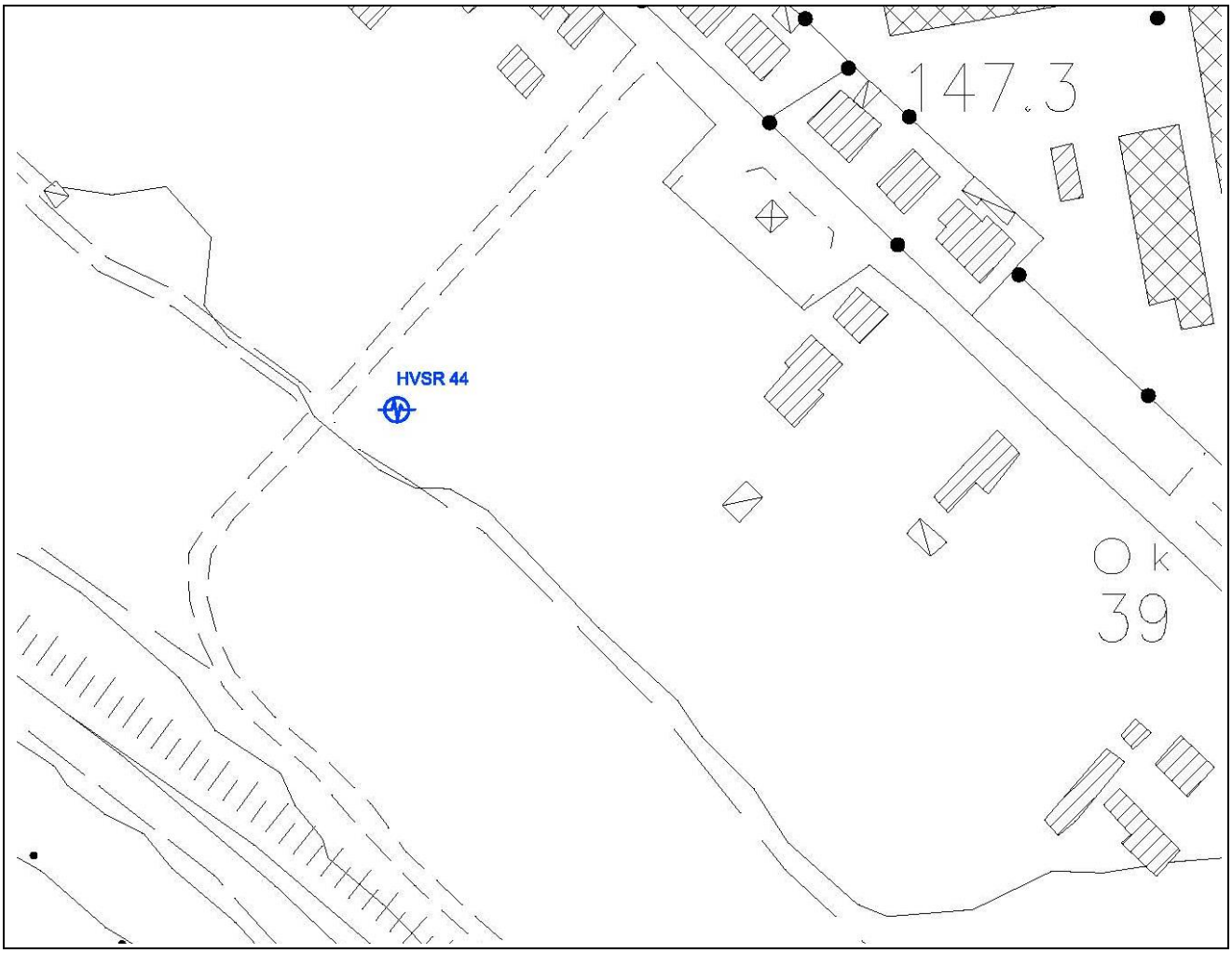


Figura 15.1 – individuazione del sito di studio - scala 1:2.000

Figura 15.2: rilievo sismico

H/V Spectral ratio

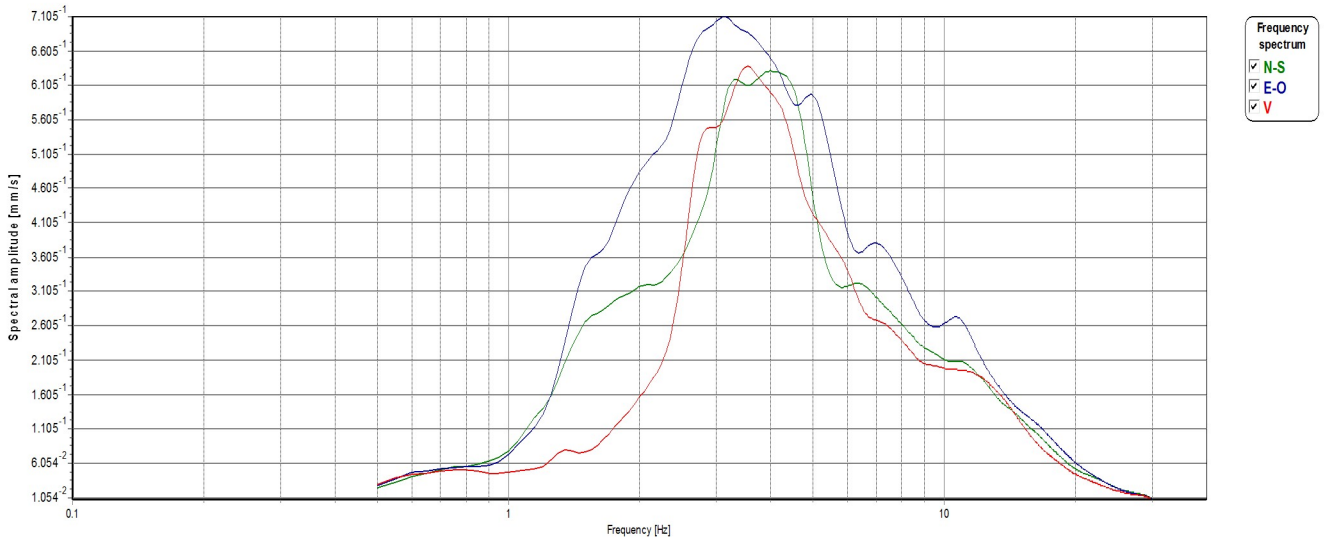
Analysis site: **Montevarchi**

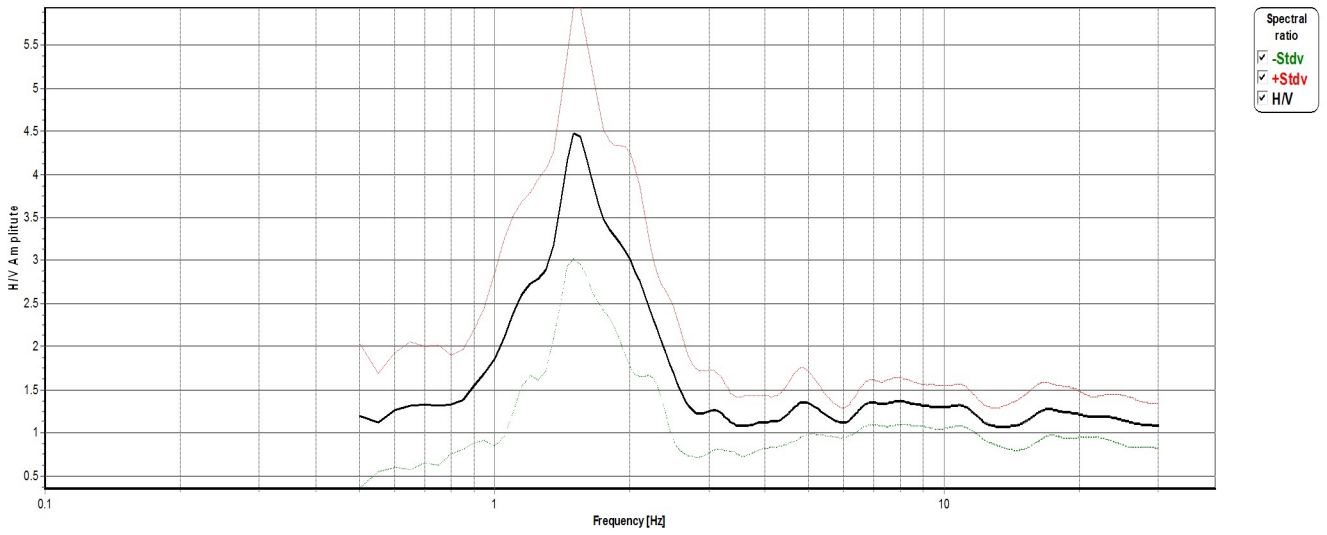
Measure point: **44 Levanelle**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 13:53:55**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 14:28:55**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**89**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**16**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.579**	Standard deviation [Hz]:	**0.173**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **44 Levanelle**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.58 >= 0.50**	**Yes**
Nc(fø) > 200	**2810.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 48**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.350**	**Yes**
Aø > 2	**4.19 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**4.98% < 5.00%**	**Yes**
sf < e(fø)	**0.1729 > 0.1579**	**No**
sA(fø) < ?(fø)	**1.3682 < 1.7800**	**Yes**

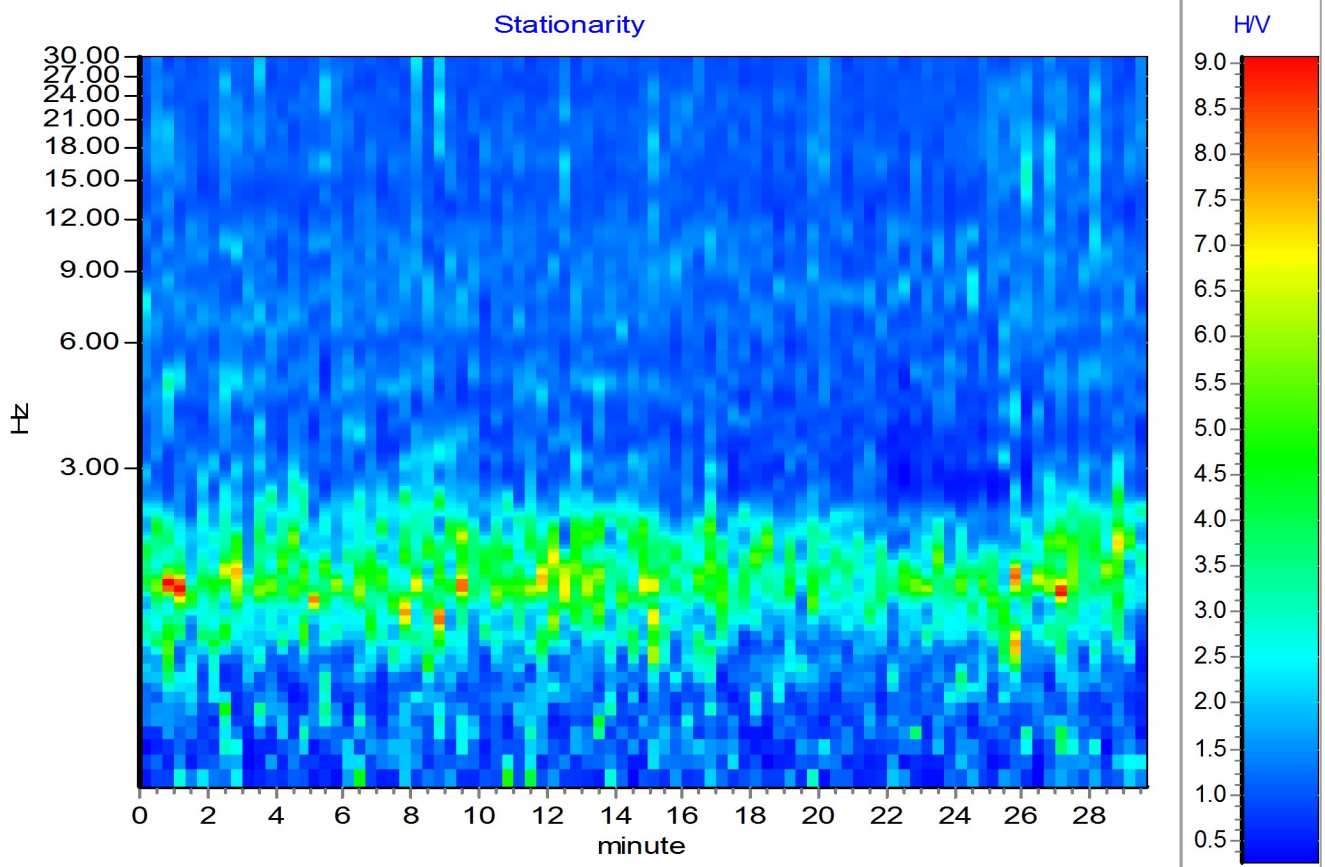
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

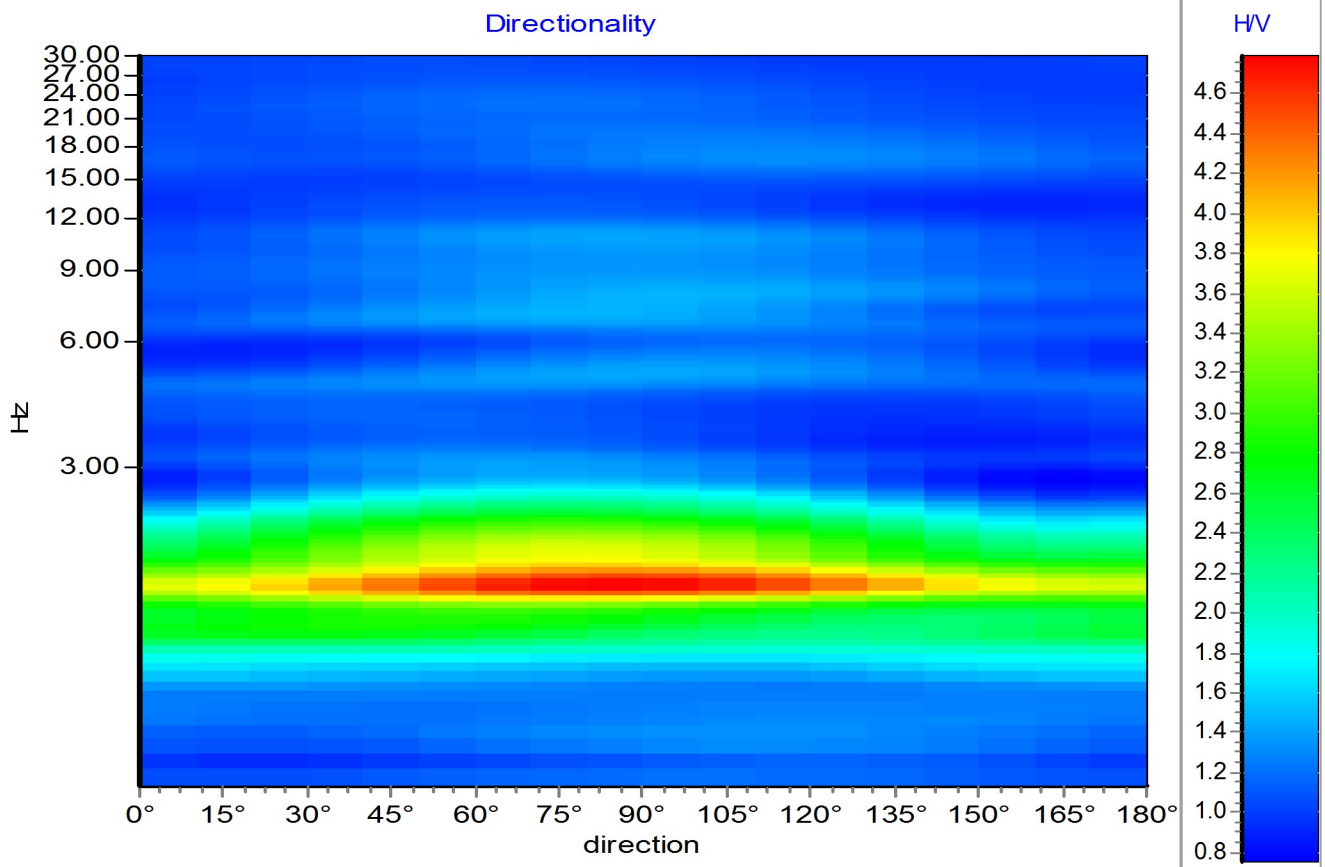
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **44 Levanelle**





Misura 45 HVRS

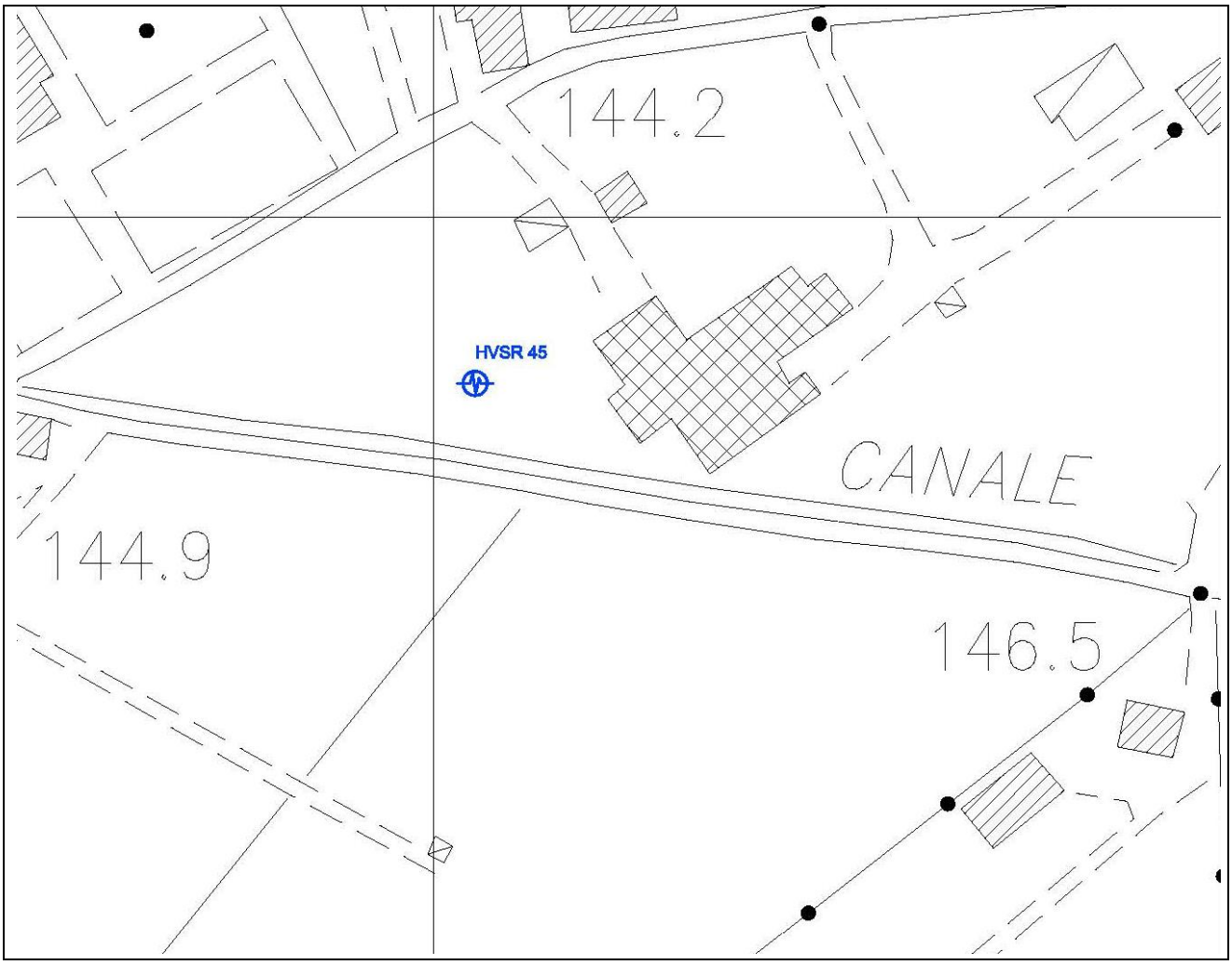


Figura 16.1 – individuazione del sito di studio - scala 1:2.000

Figura 16.2: rilievo sismico

H/V Spectral ratio

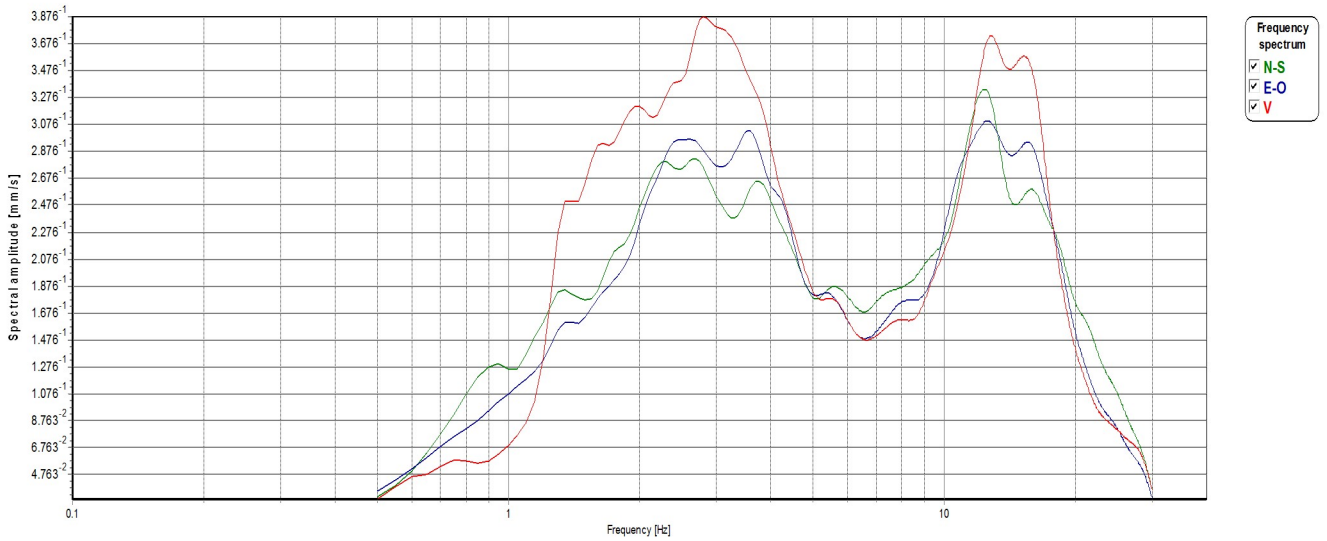
Analysis site: **Montevarchi**

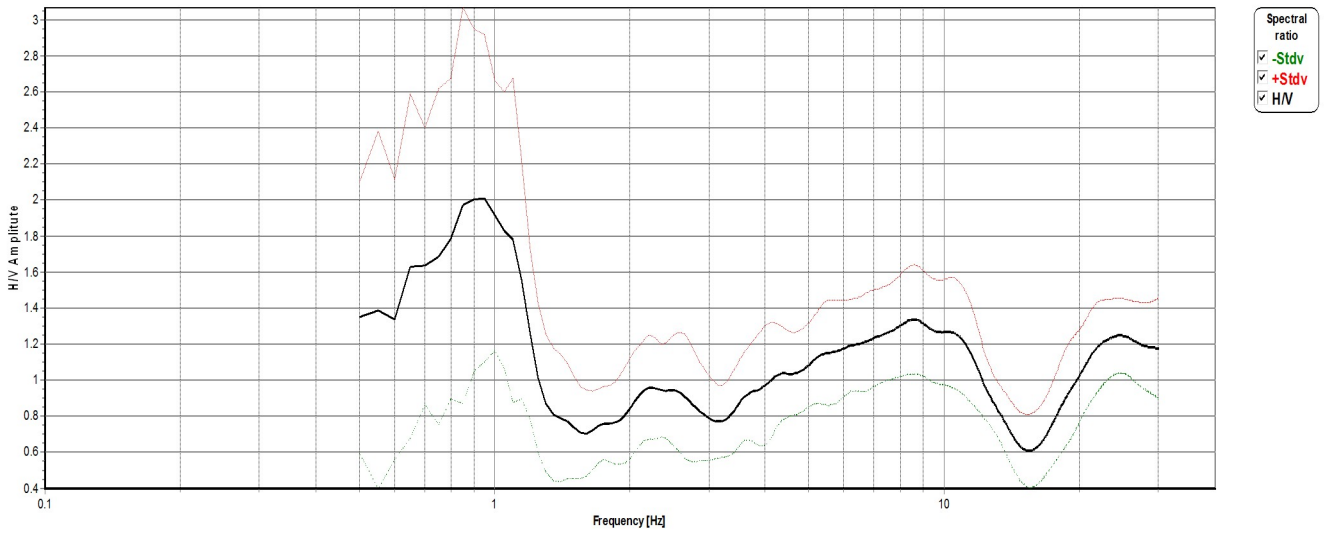
Measure point: **45 Podere Pinaccio**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 17:58:02**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 18:33:02**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**90**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**15**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.837**	Standard deviation [Hz]:	**0.178**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **45 Podere Pinaccio**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.84 >= 0.50**	**Yes**
Nc(fø) > 200	**1506.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 24**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.300**	**Yes**
Aø > 2	**1.97 < 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**19.52% > 5.00%**	**No**
sf < e(fø)	**0.1778 > 0.1255**	**No**
sA(fø) < ?(fø)	**1.0971 < 2.0000**	**Yes**

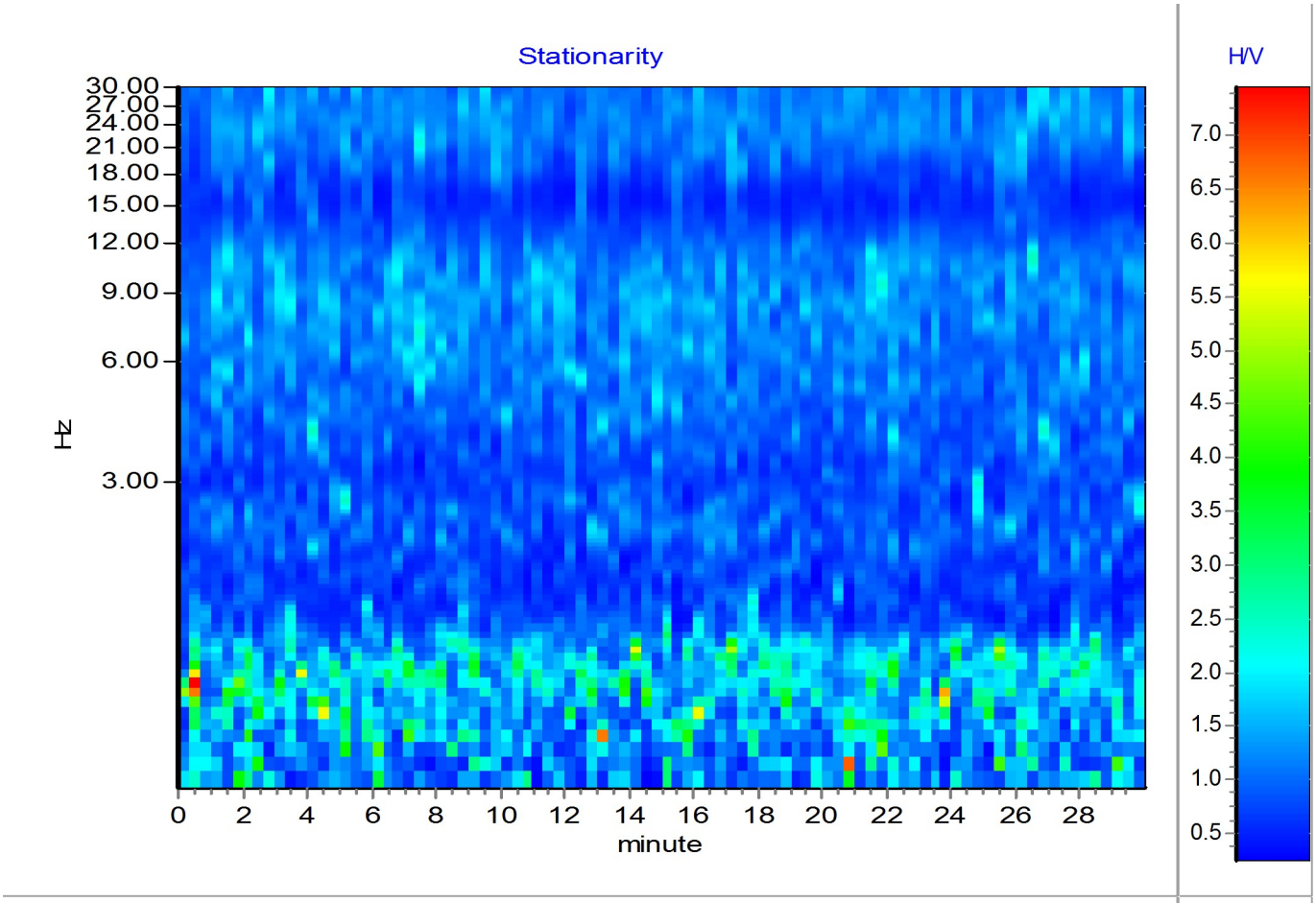
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

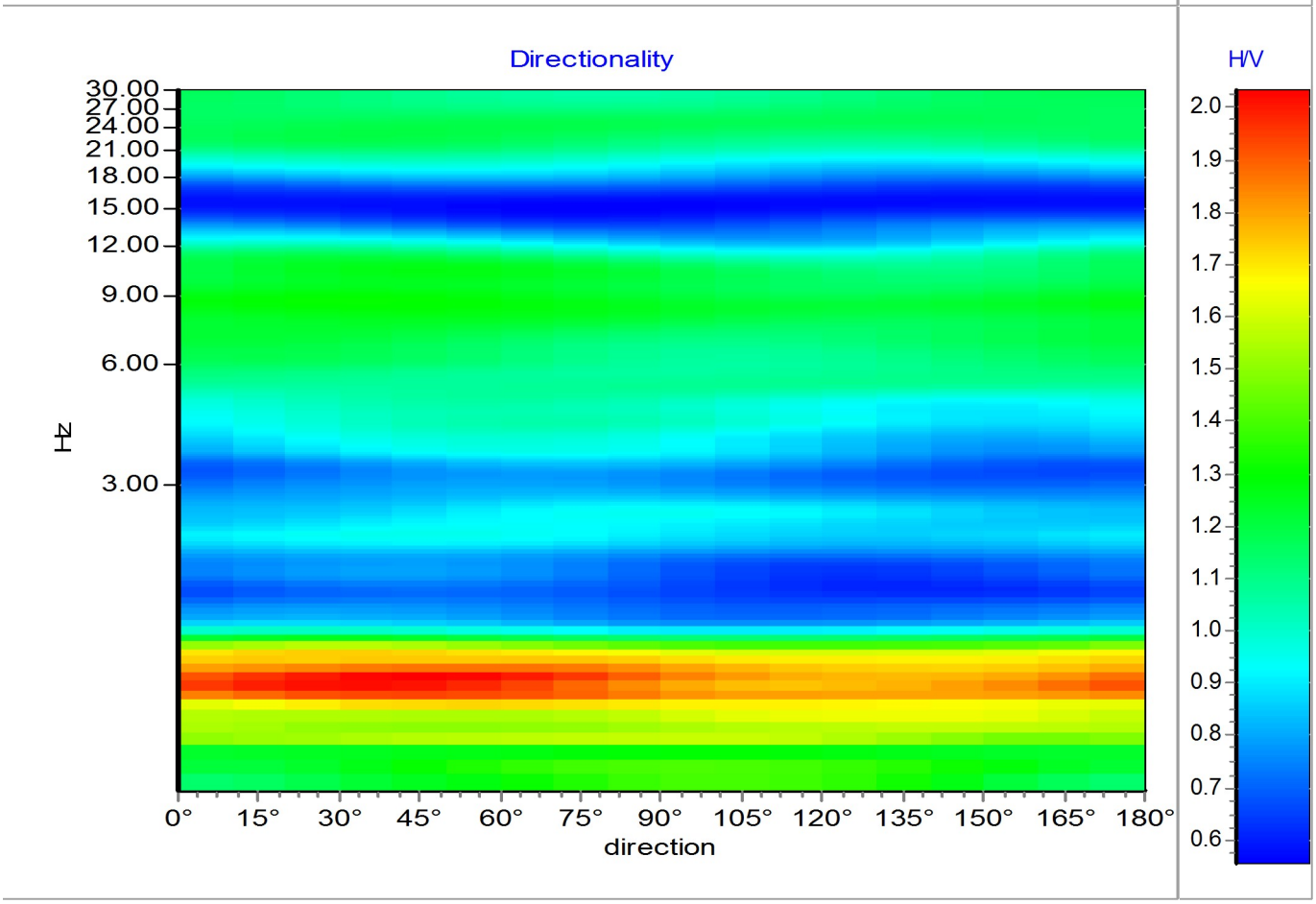
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **45 Podere Pinaccio**





Misura 46 HVRS

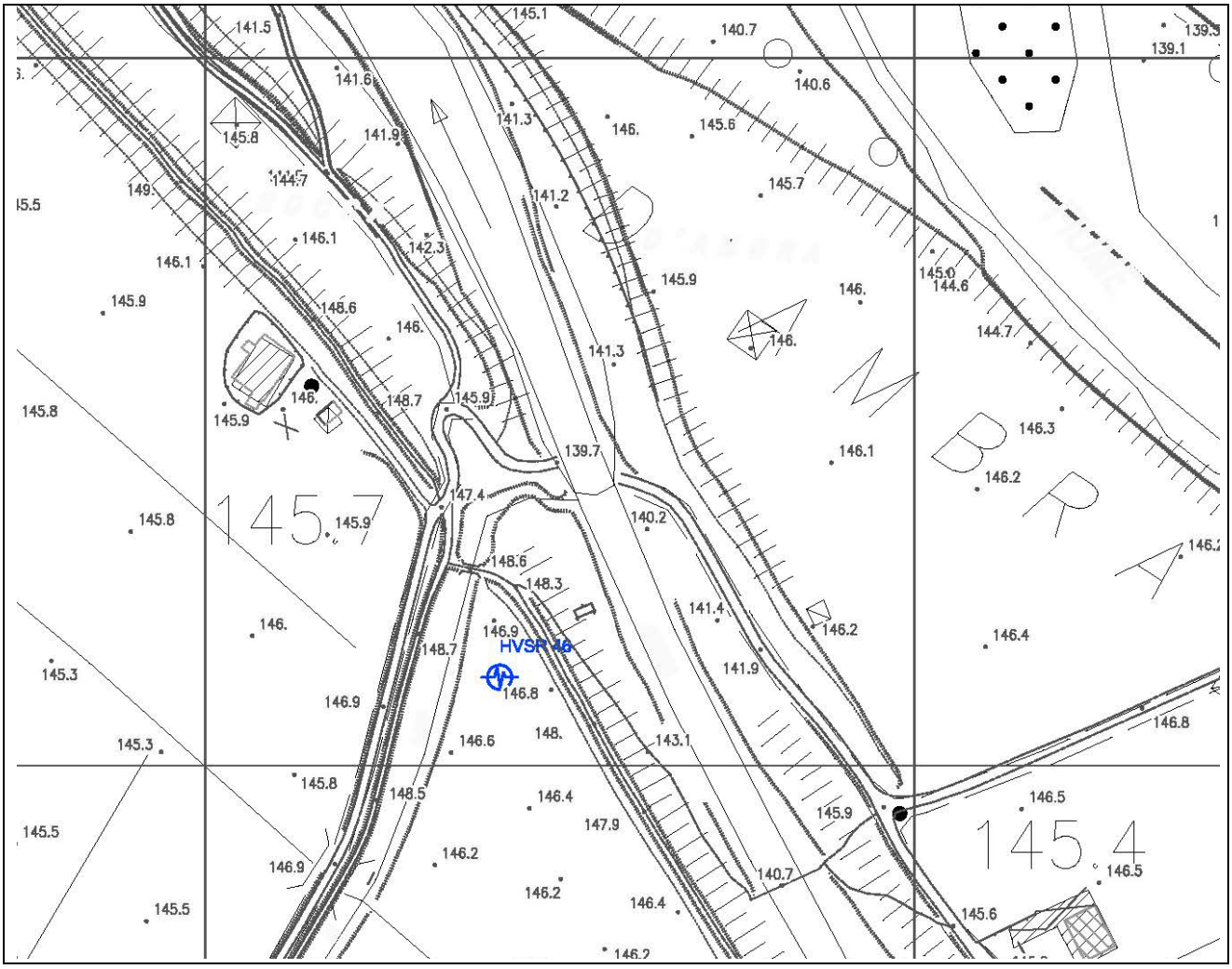


Figura 17.1 – individuazione del sito di studio - scala 1:2.000

Figura 17.2: rilievo sismico

H/V Spectral ratio

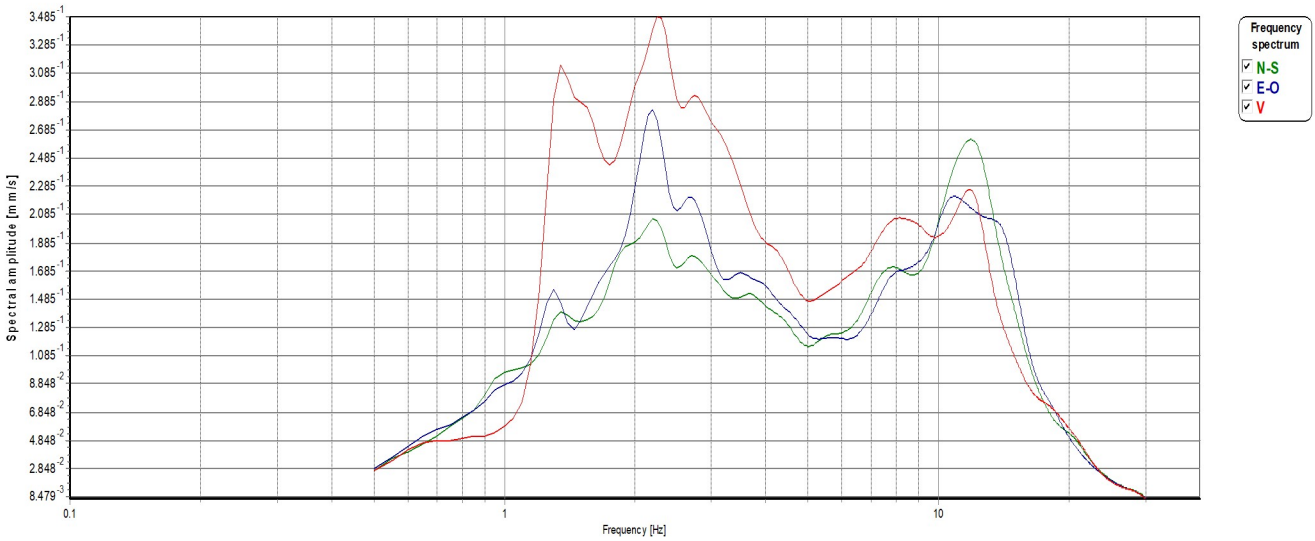
Analysis site: **Montevarchi**

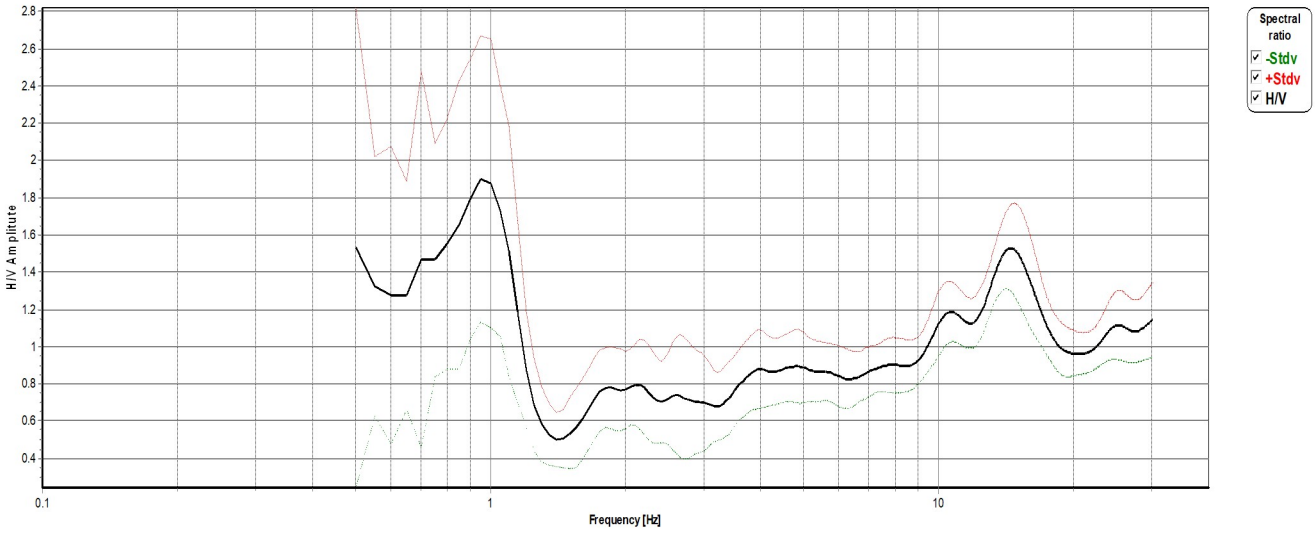
Measure point: **46 Val di Lago di Sopra**

Note: Montevarchi

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**12/08/2021 12:02:18**
Automatic spike removal:	**No**	Stop recordings:	**12/08/2021 12:37:18**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**100**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**5**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.805**	Standard deviation [Hz]:	**0.198**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **46 Val di Lago di Sopra**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.81 >= 0.50**	**Yes**
Nc(fø) > 200	**1610.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 23**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.250**	**Yes**
Aø > 2	**1.55 < 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**1657.80% > 5.00%**	**No**
sf < e(fø)	**0.1984 > 0.1208**	**No**
sA(fø) < ?(fø)	**0.6715 < 2.0000**	**Yes**

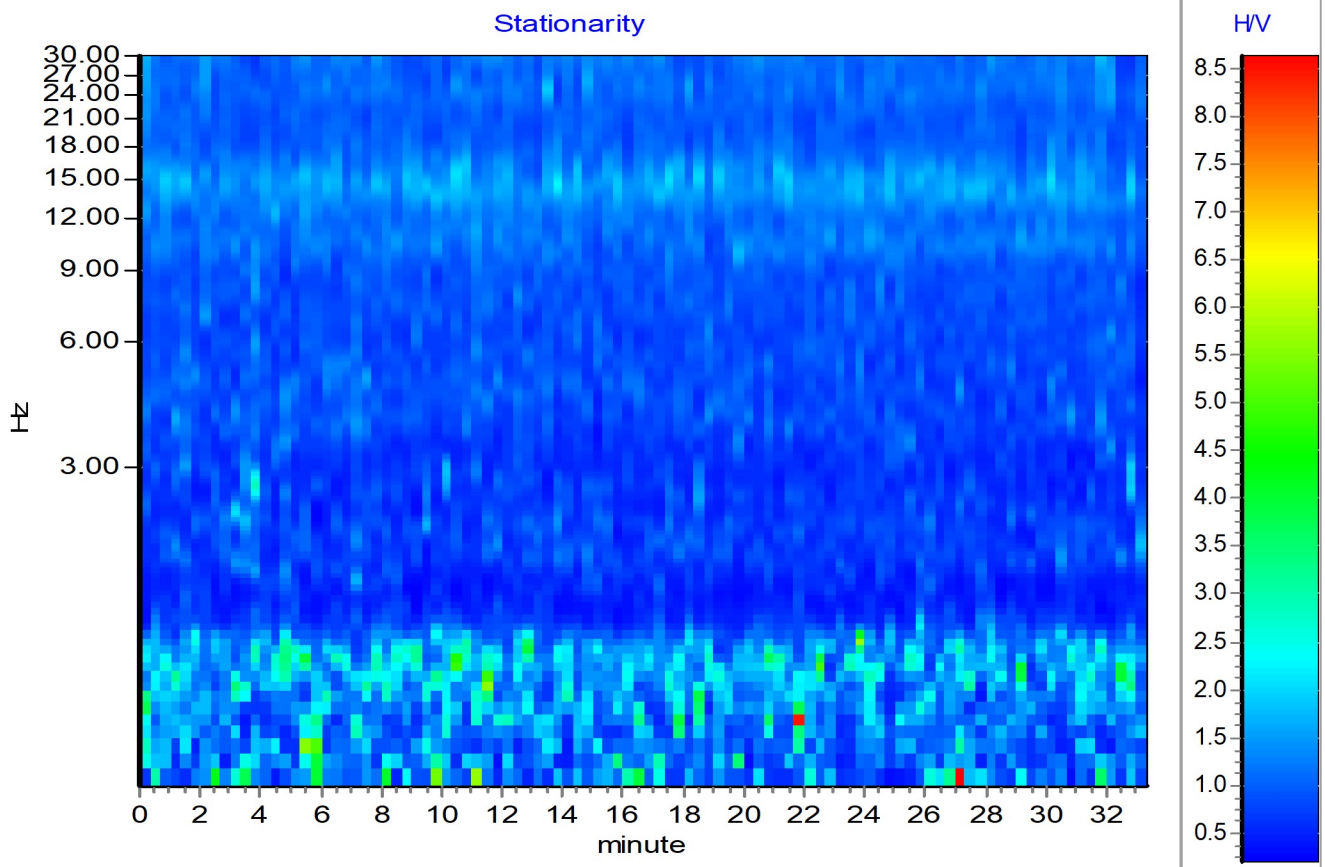
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

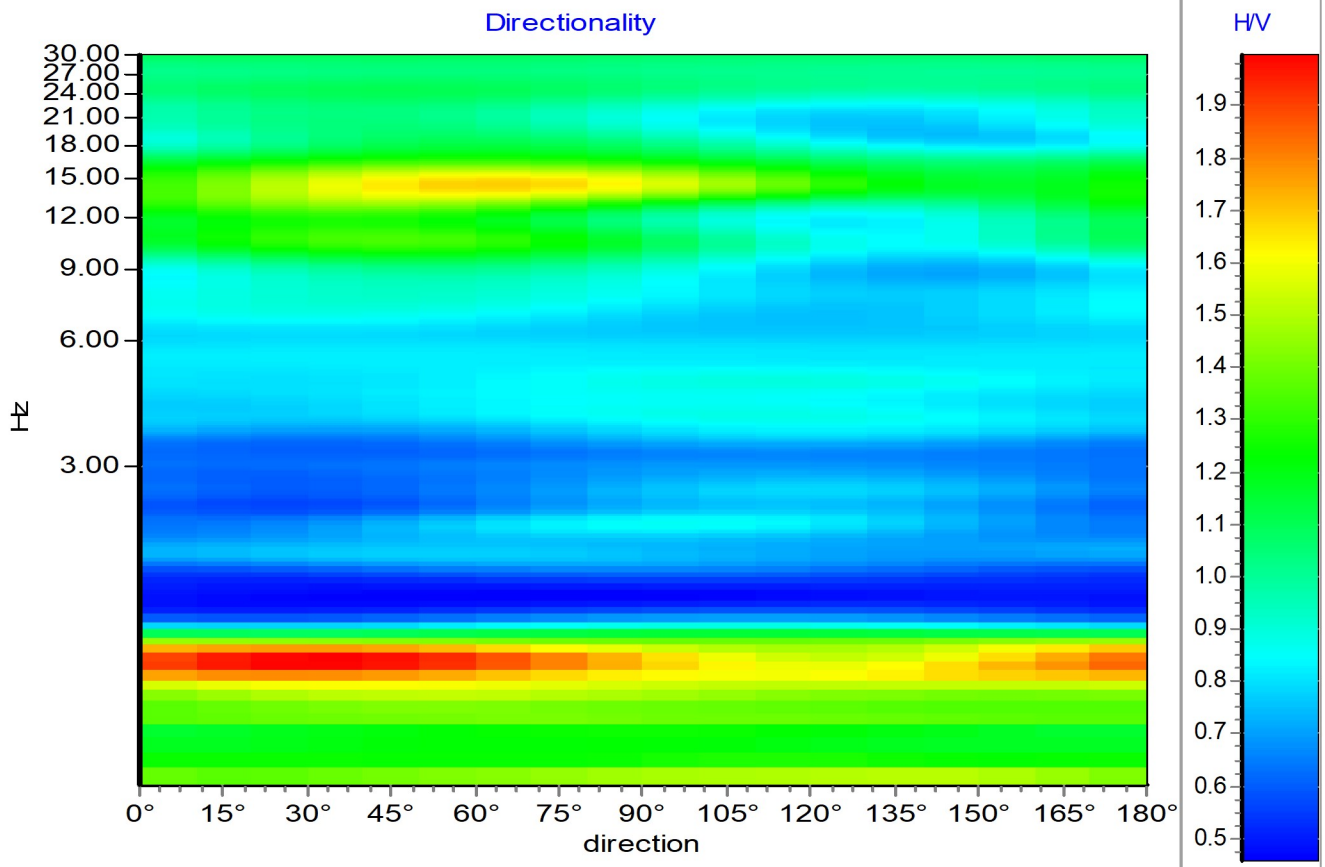
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **46 Val di Lago di Sopra**





Misura 47 HVRS

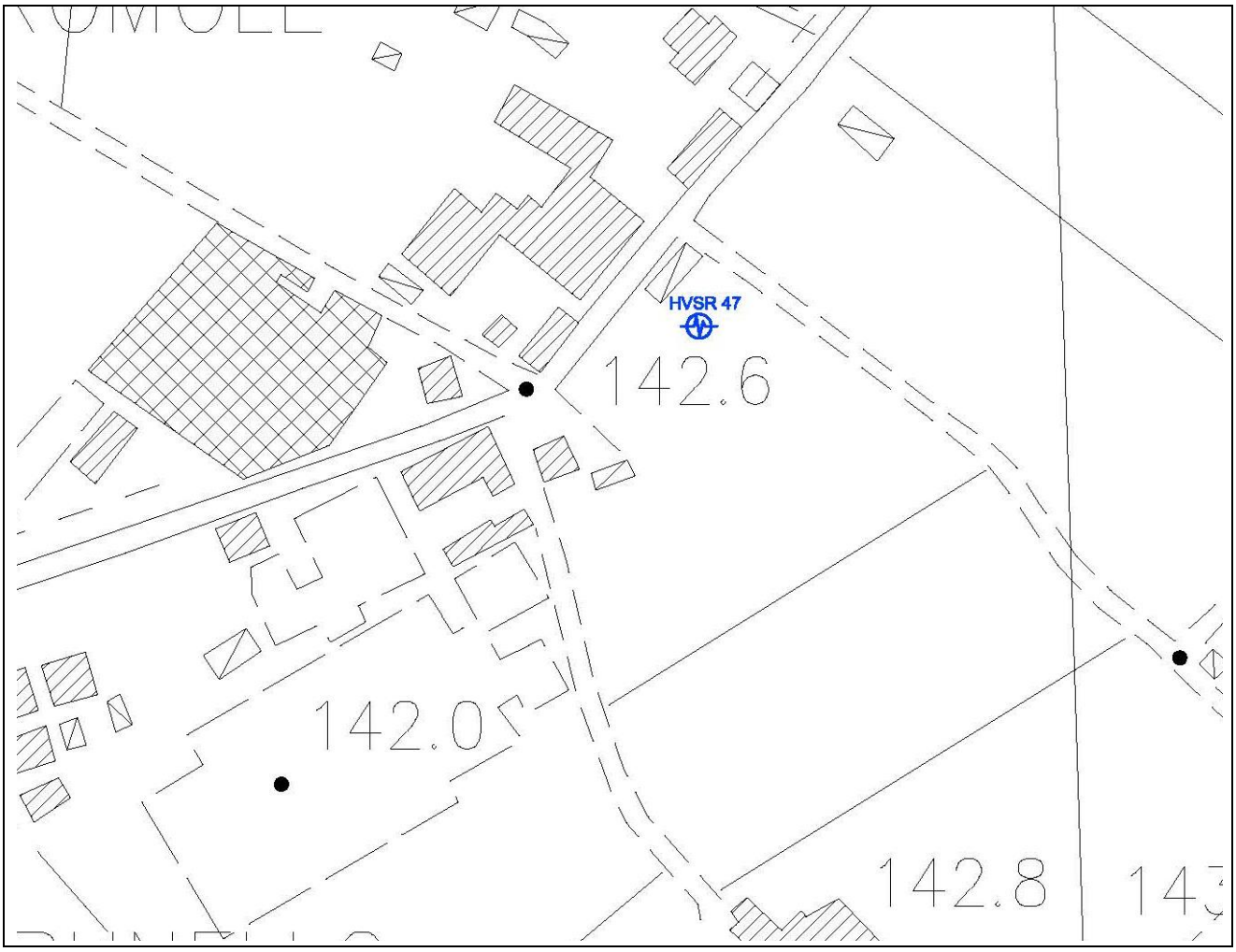


Figura 18.1 – individuazione del sito di studio - scala 1:2.000

Figura 18.2: rilievo sismico

H/V Spectral ratio

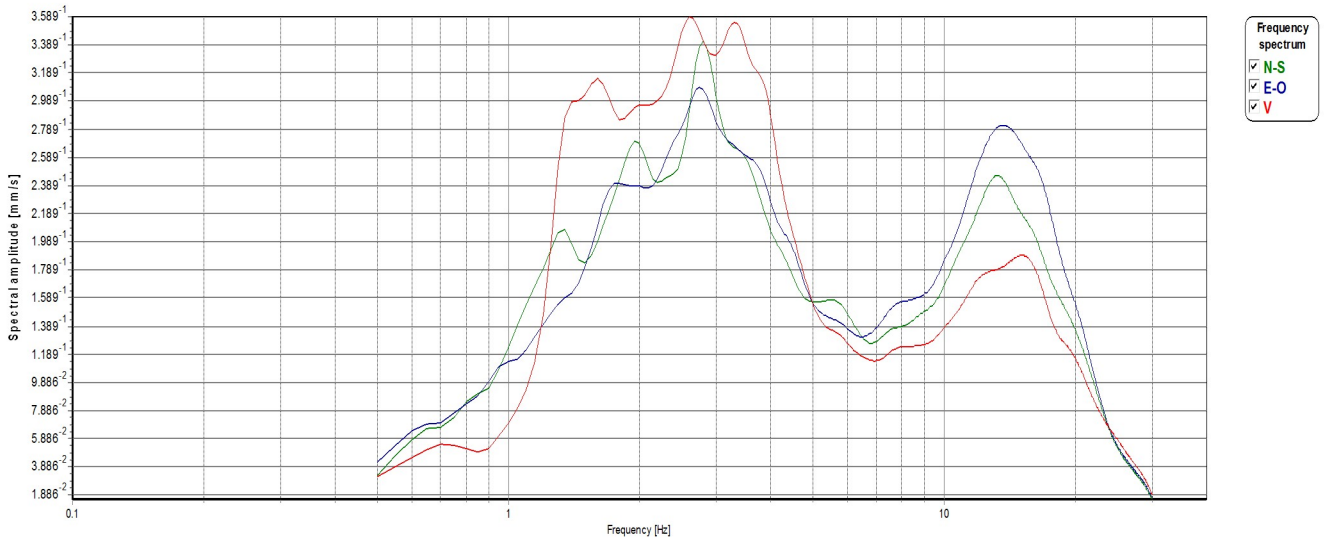
Analysis site: **Montevarchi**

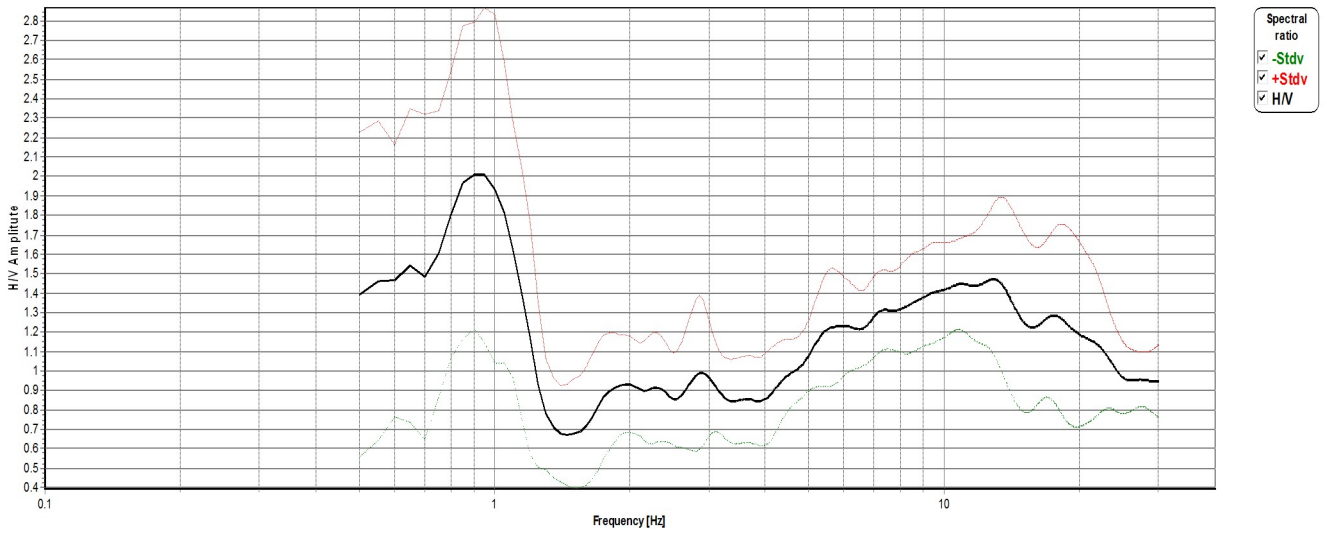
Measure point: **47 Il Prunello**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**10/05/2021 17:11:51**
Automatic spike removal:	**No**	Stop recordings:	**10/05/2021 17:46:51**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**80**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**25**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.851**	Standard deviation [Hz]:	**0.290**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **47 Il Prunello**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.85 >= 0.50**	**Yes**
Nc(fø) > 200	**1362.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 25**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.250**	**Yes**
Aø > 2	**1.97 < 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**11.60% > 5.00%**	**No**
sf < e(fø)	**0.2901 > 0.1277**	**No**
sA(fø) < ?(fø)	**0.8085 < 2.0000**	**Yes**

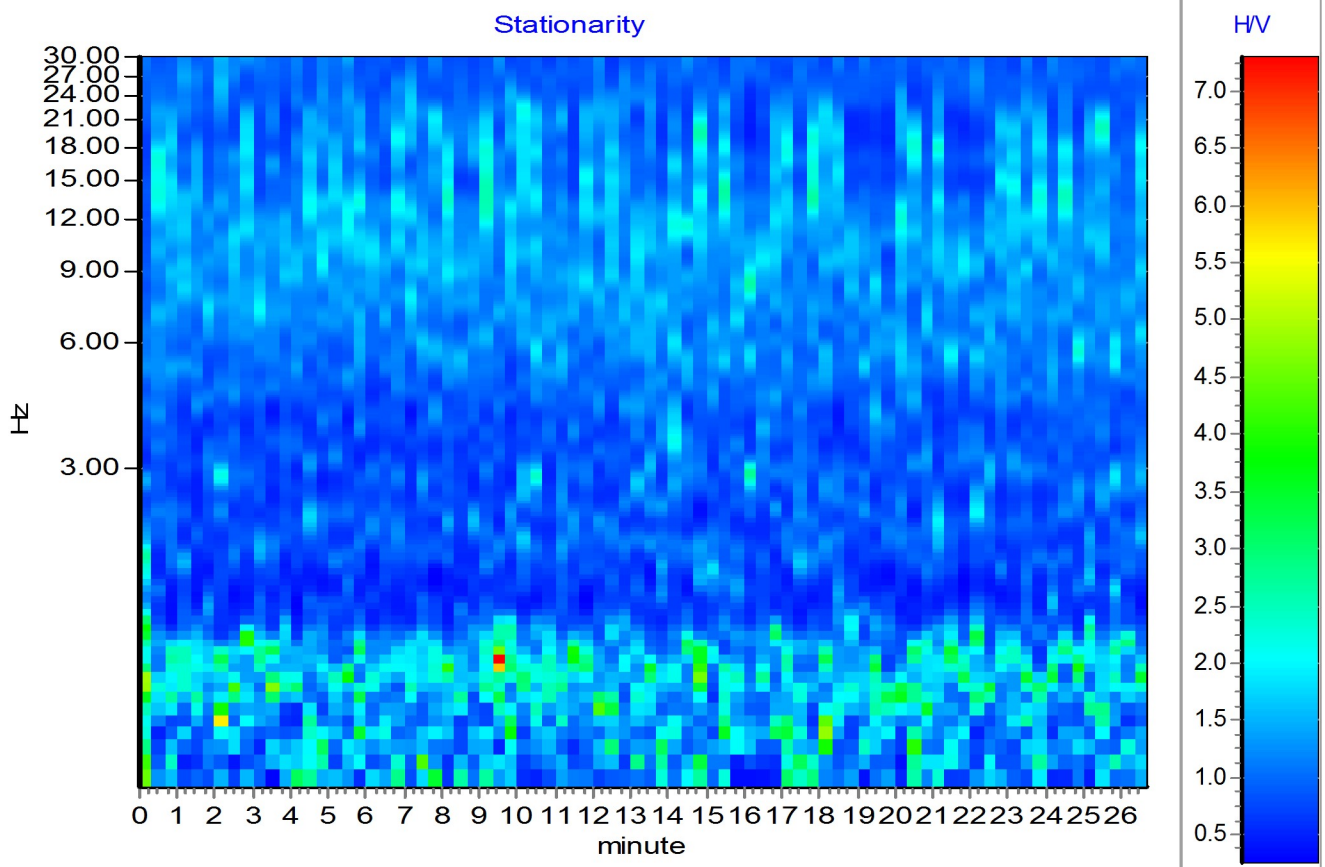
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

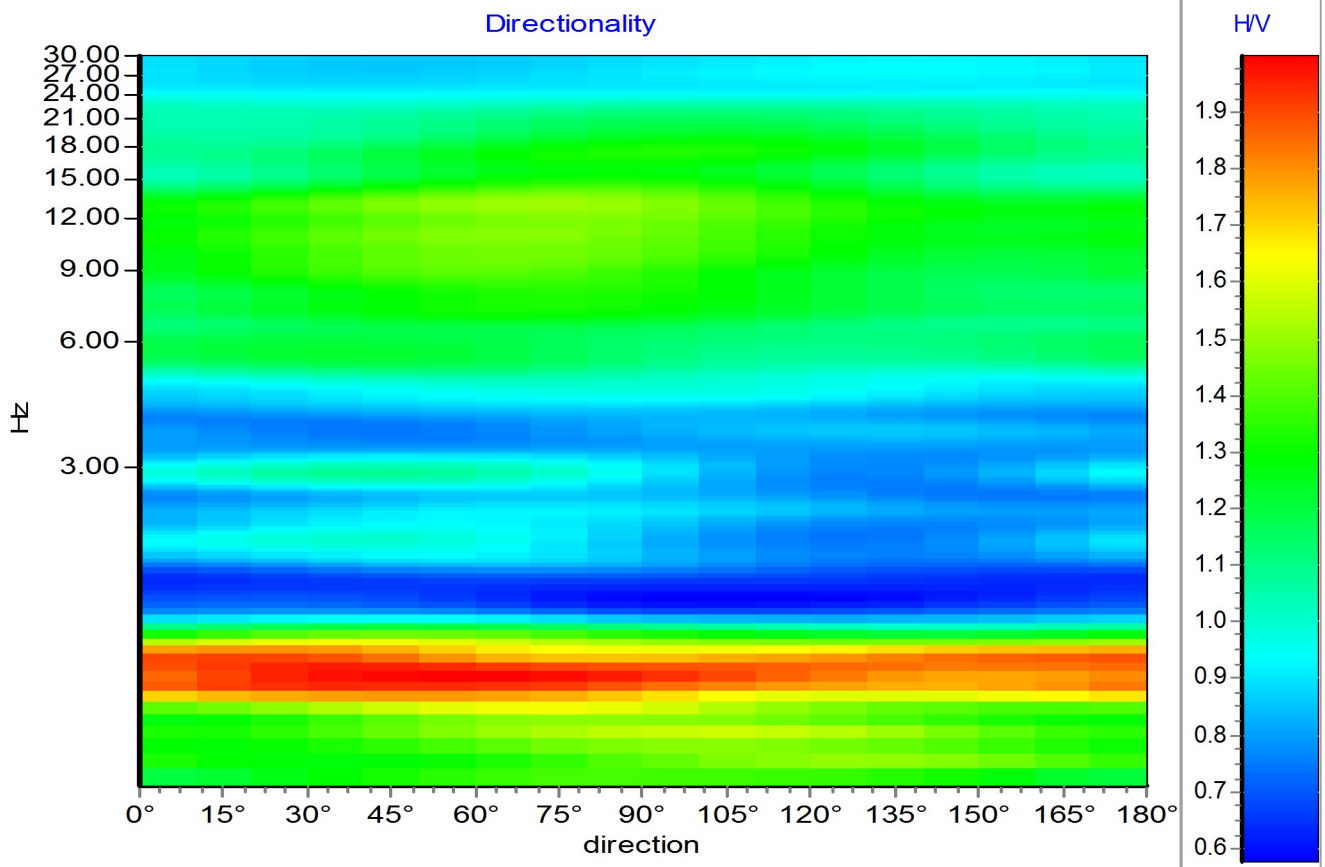
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **47 Il Prunello**





Misura 48 HVRS

Figura 19.1 – individuazione del sito di studio - scala 1:2.000

Figura 19.2: rilievo sismico

H/V Spectral ratio

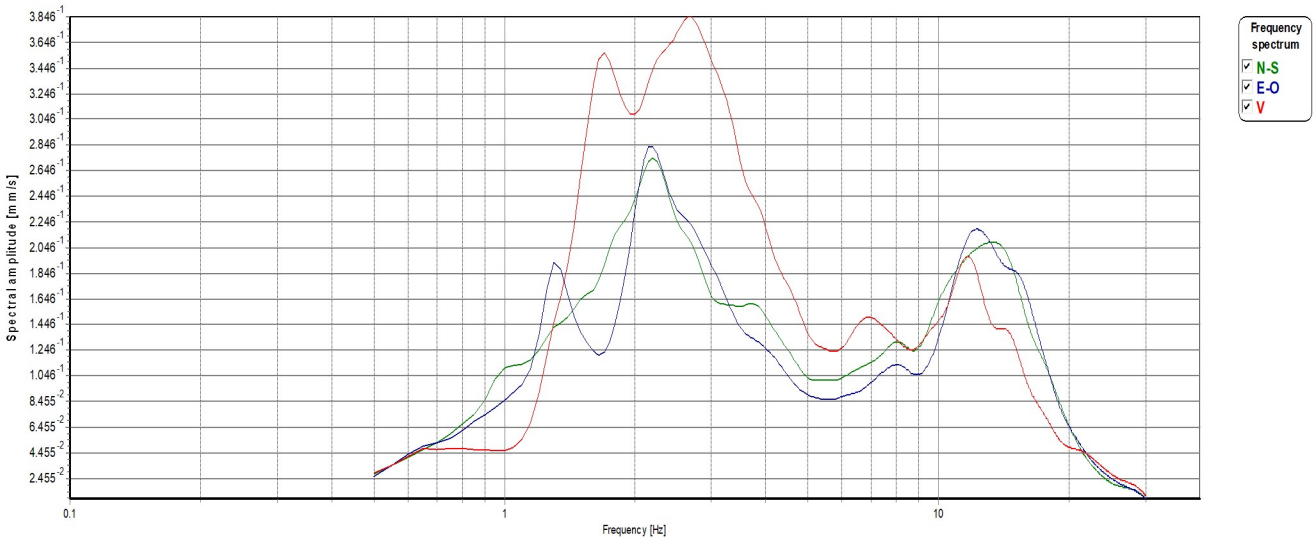
Analysis site: **Montevarchi**

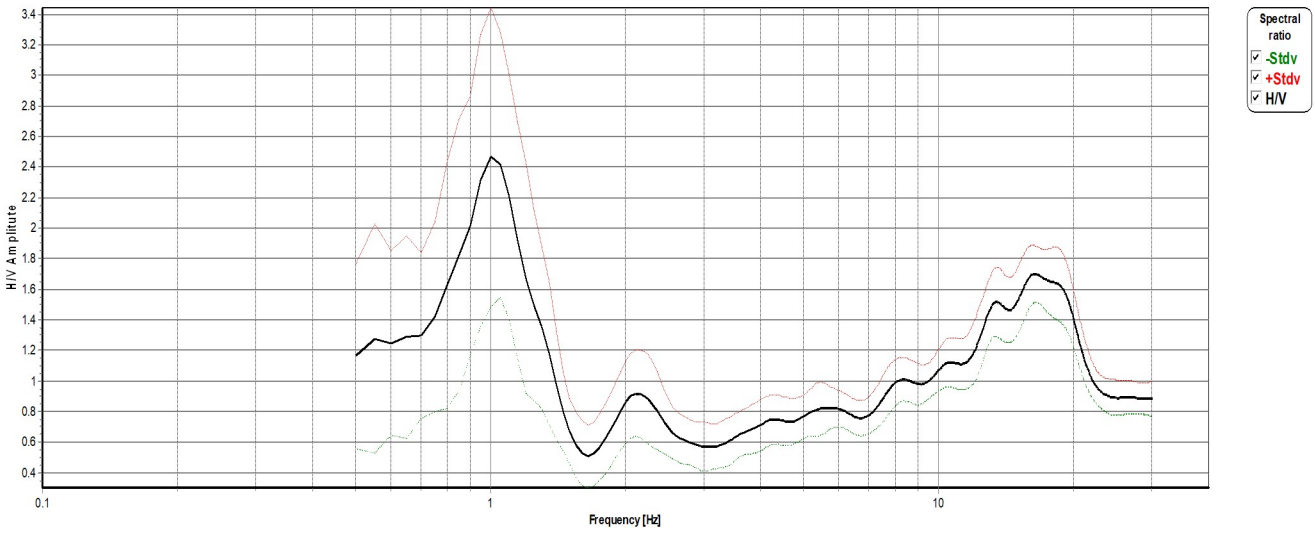
Measure point: **48 Casa Sprondoro 2**

Note: Montevarchi

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**12/08/2021 11:06:56**
Automatic spike removal:	**No**	Stop recordings:	**12/08/2021 11:46:56**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**105**
Lw Windows [s]:	**20**	Recording length [s]:	**2400**
Overlap Windows s]:	**0.0**	Discarded windows:	**15**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**0.960**	Standard deviation [Hz]:	**0.180**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **48 Casa Sprondoro 2**

Criteria for a reliable H/V curve		
fø > 10/Lw	**0.96 >= 0.50**	**Yes**
Nc(fø) > 200	**2015.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 29**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**Not exist**	**No**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.400**	**Yes**
Aø > 2	**2.31 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**9.43% > 5.00%**	**No**
sf < e(fø)	**0.1796 > 0.1439**	**No**
sA(fø) < ?(fø)	**0.9566 < 2.0000**	**Yes**

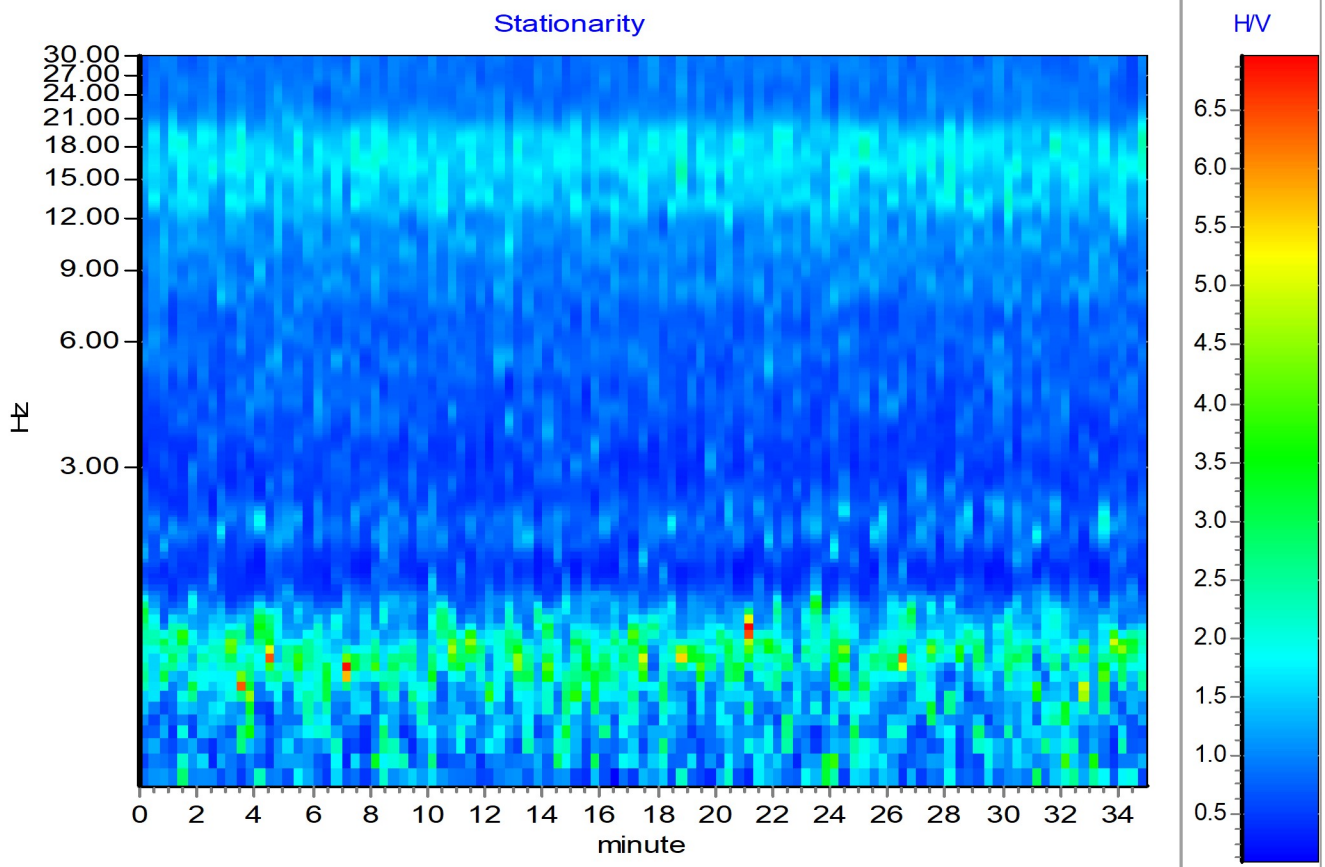
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

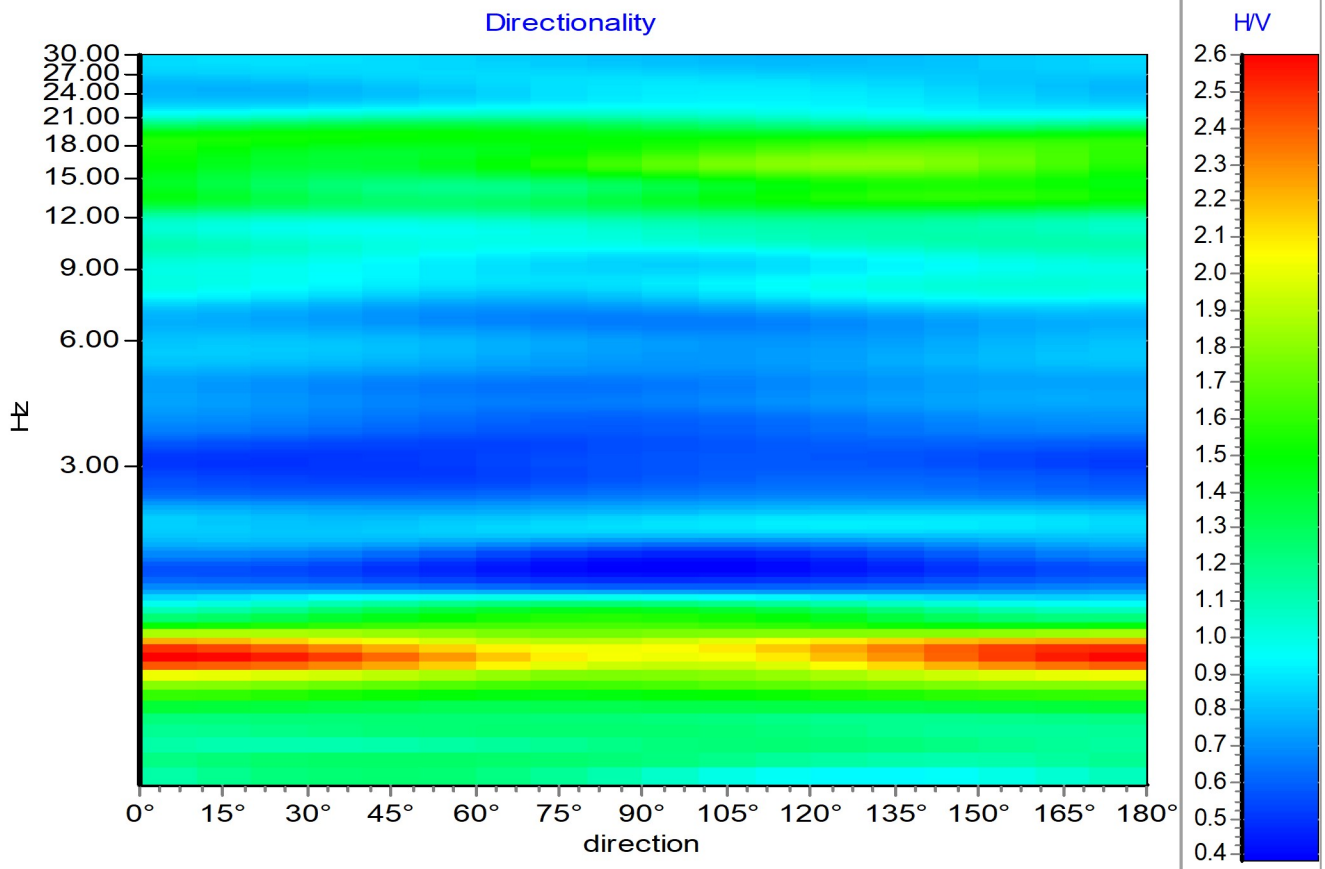
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **48 Casa Sprondoro 2**





Misura 49 HVRS

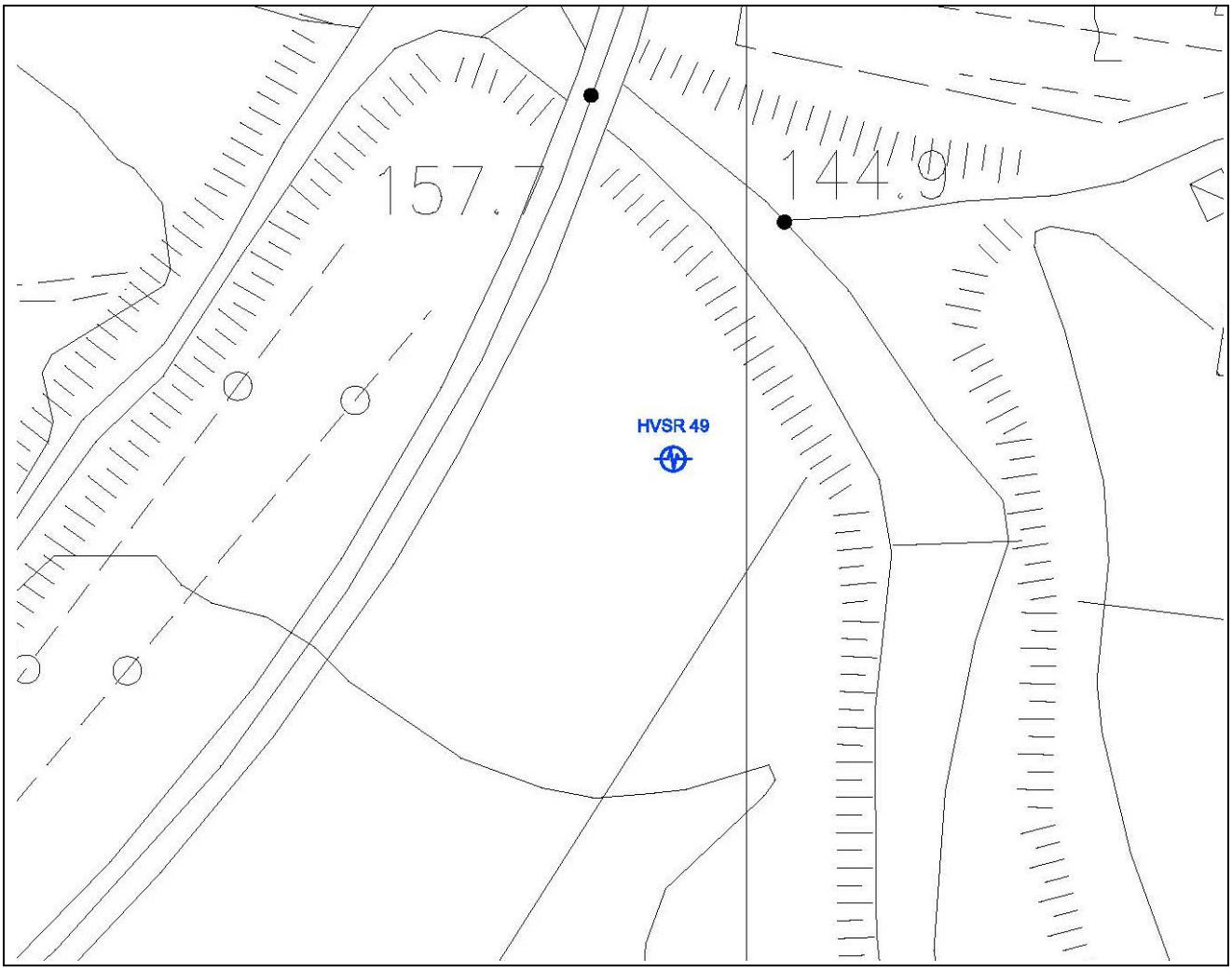


Figura 20.1 – individuazione del sito di studio - scala 1:2.000

Figura 20.2: rilievo sismico

H/V Spectral ratio

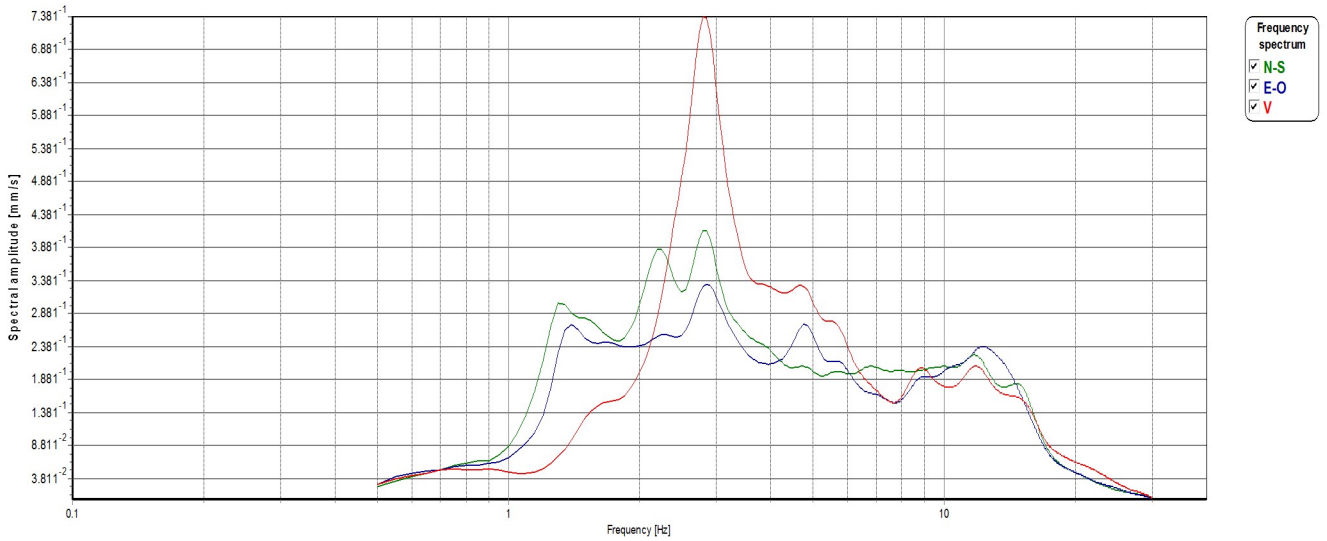
Analysis site: **Montevarchi**

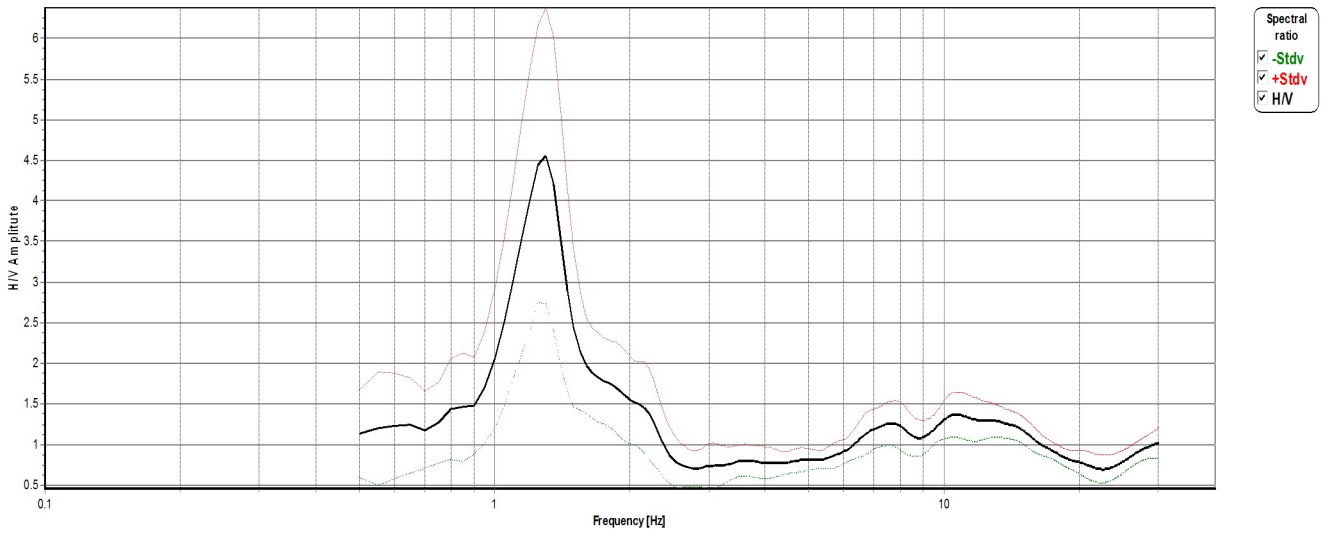
Measure point: **49 Viadotto**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 12:52:56**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 13:27:56**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**102**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**3**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.268**	Standard deviation [Hz]:	**0.113**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **49 Viadotto**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.27 >= 0.50**	**Yes**
Nc(fø) > 200	**2587.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 38**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.550**	**Yes**
Aø > 2	**4.45 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**2.51% < 5.00%**	**Yes**
sf < e(fø)	**0.1131 < 0.1268**	**Yes**
sA(fø) < ?(fø)	**1.7008 < 1.7800**	**Yes**

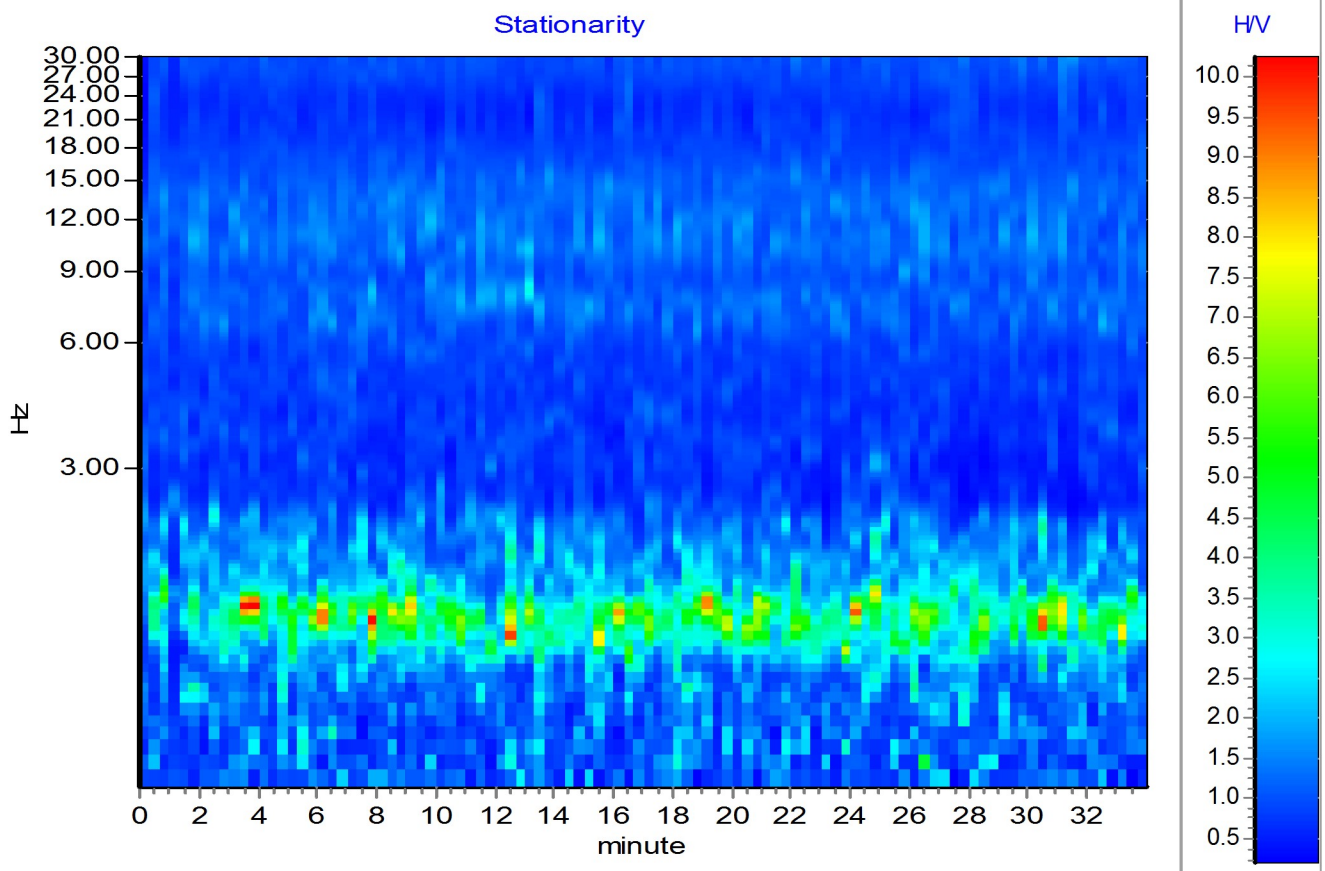
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

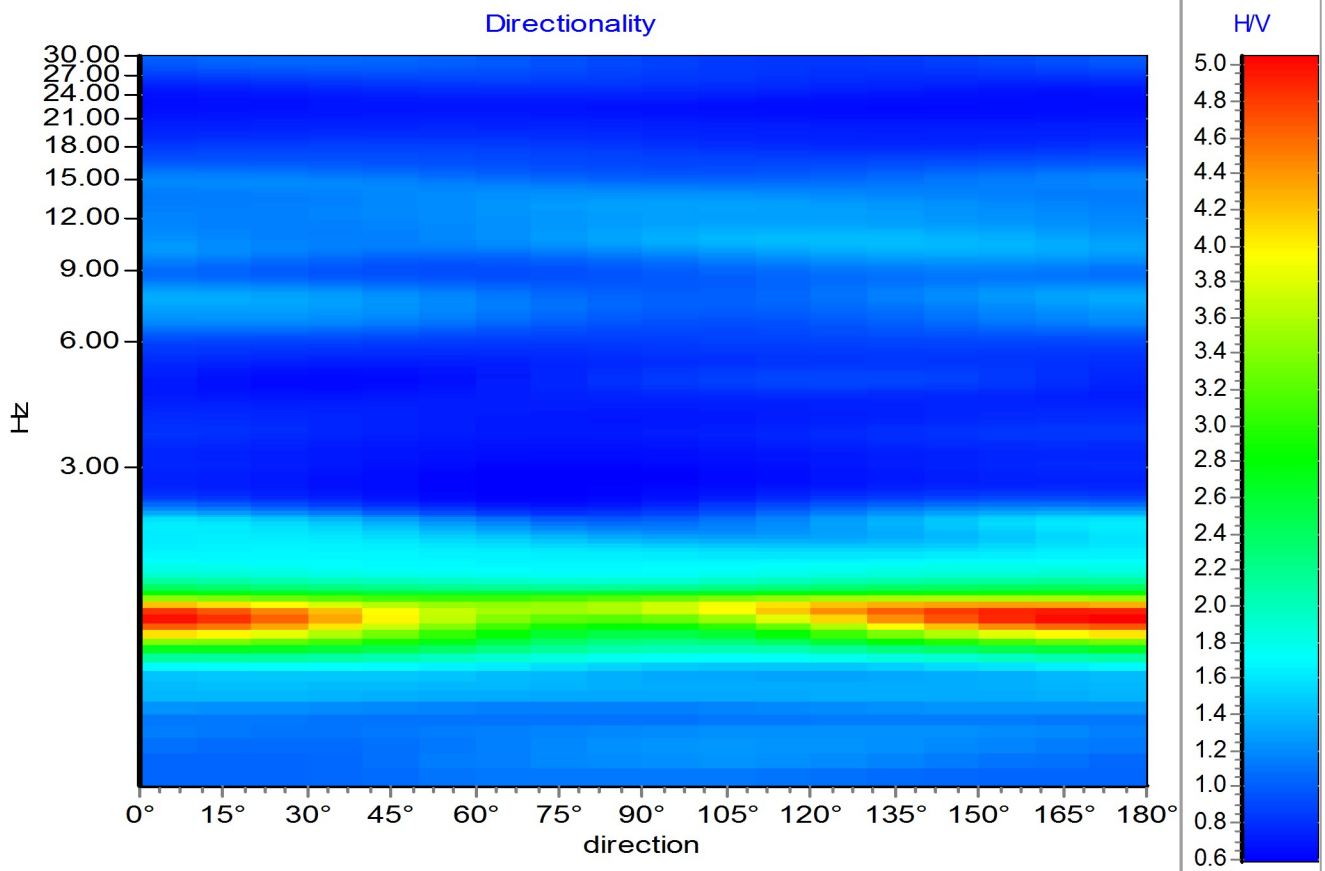
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **49 Viadotto**





Misura 50 HVRS

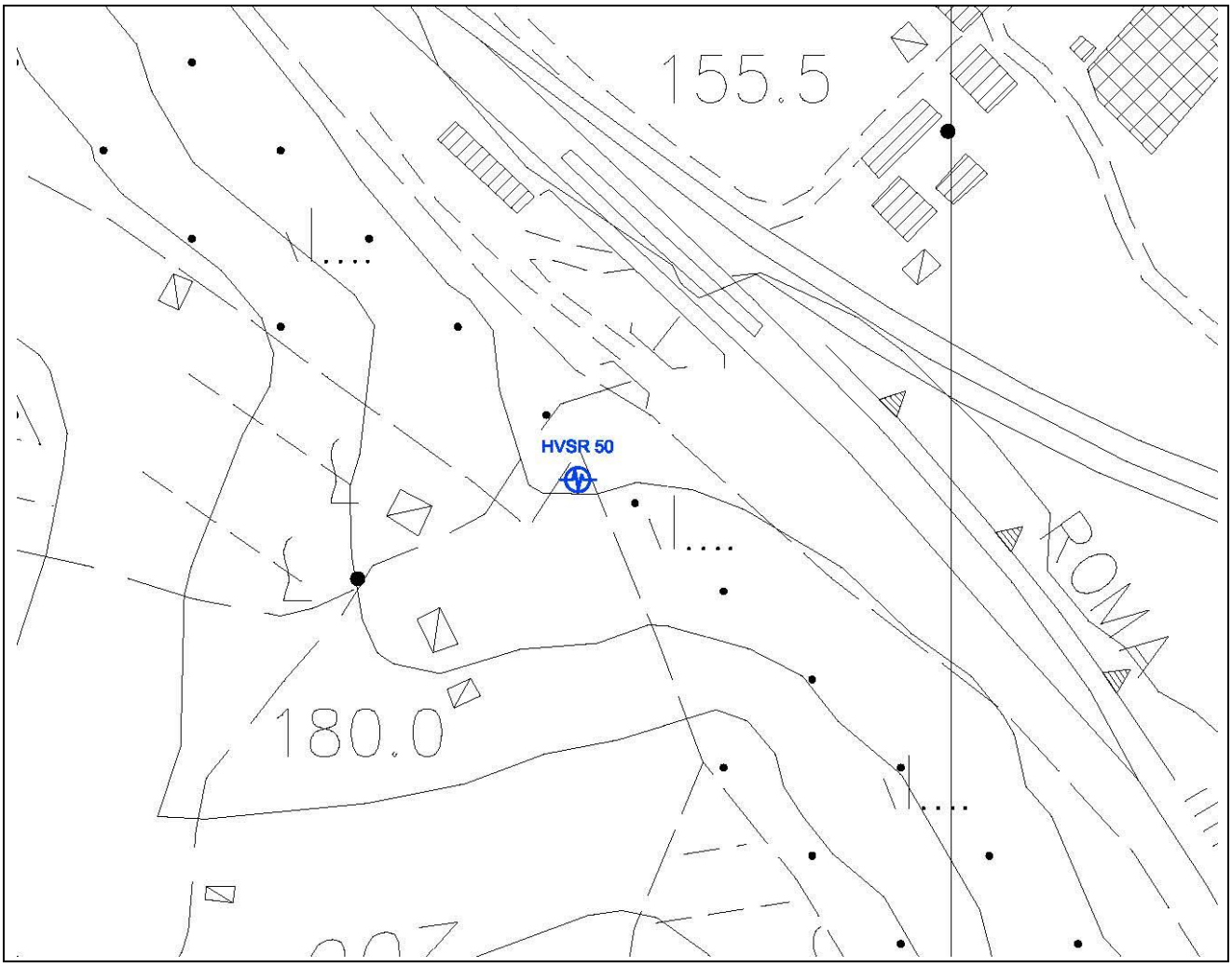


Figura 21.1 – individuazione del sito di studio - scala 1:2.000

Figura 21.2: rilievo sismico

H/V Spectral ratio

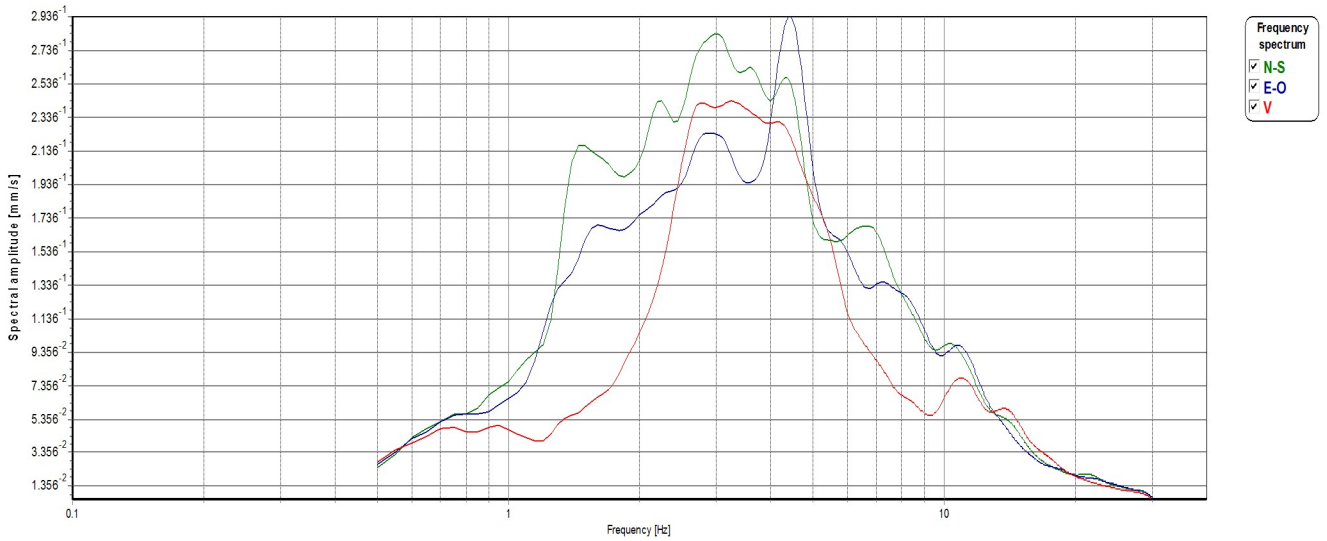
Analysis site: **Montevarchi**

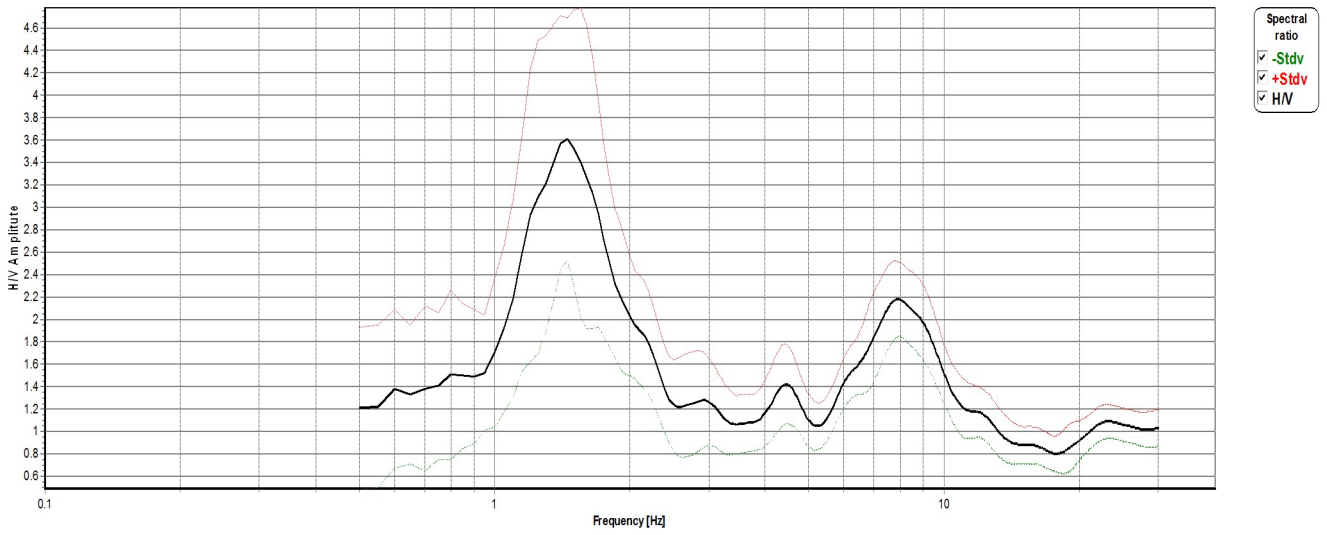
Measure point: **50 Ferrovia**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 14:43:26**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 15:18:26**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**92**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**13**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.430**	Standard deviation [Hz]:	**0.178**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **50 Ferrovia**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.43 >= 0.50**	**Yes**
Nc(fø) > 200	**2632.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 43**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.200**	**Yes**
Aø > 2	**3.61 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**8.36% > 5.00%**	**No**
sf < e(fø)	**0.1775 > 0.1430**	**No**
sA(fø) < ?(fø)	**1.0795 < 1.7800**	**Yes**

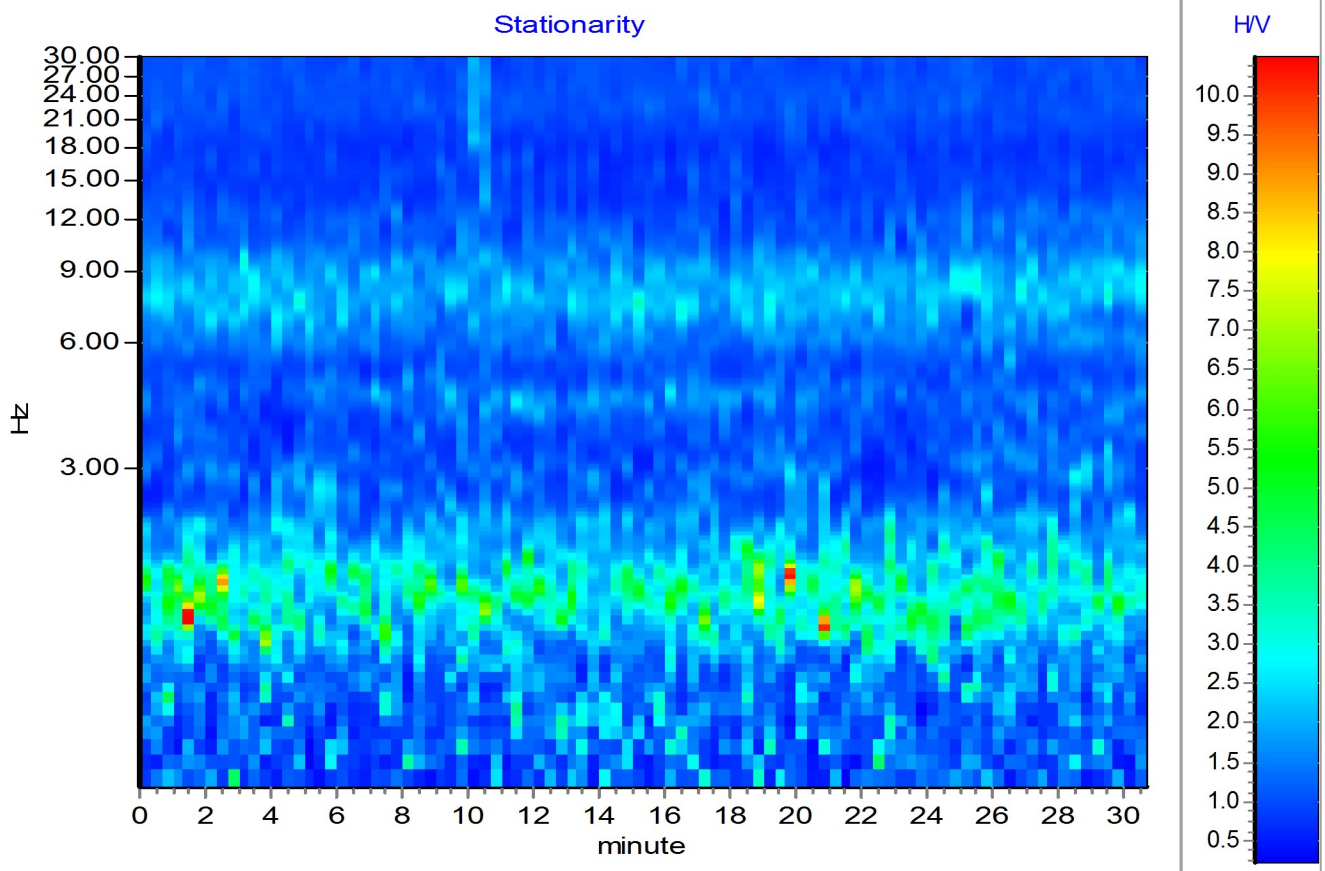
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

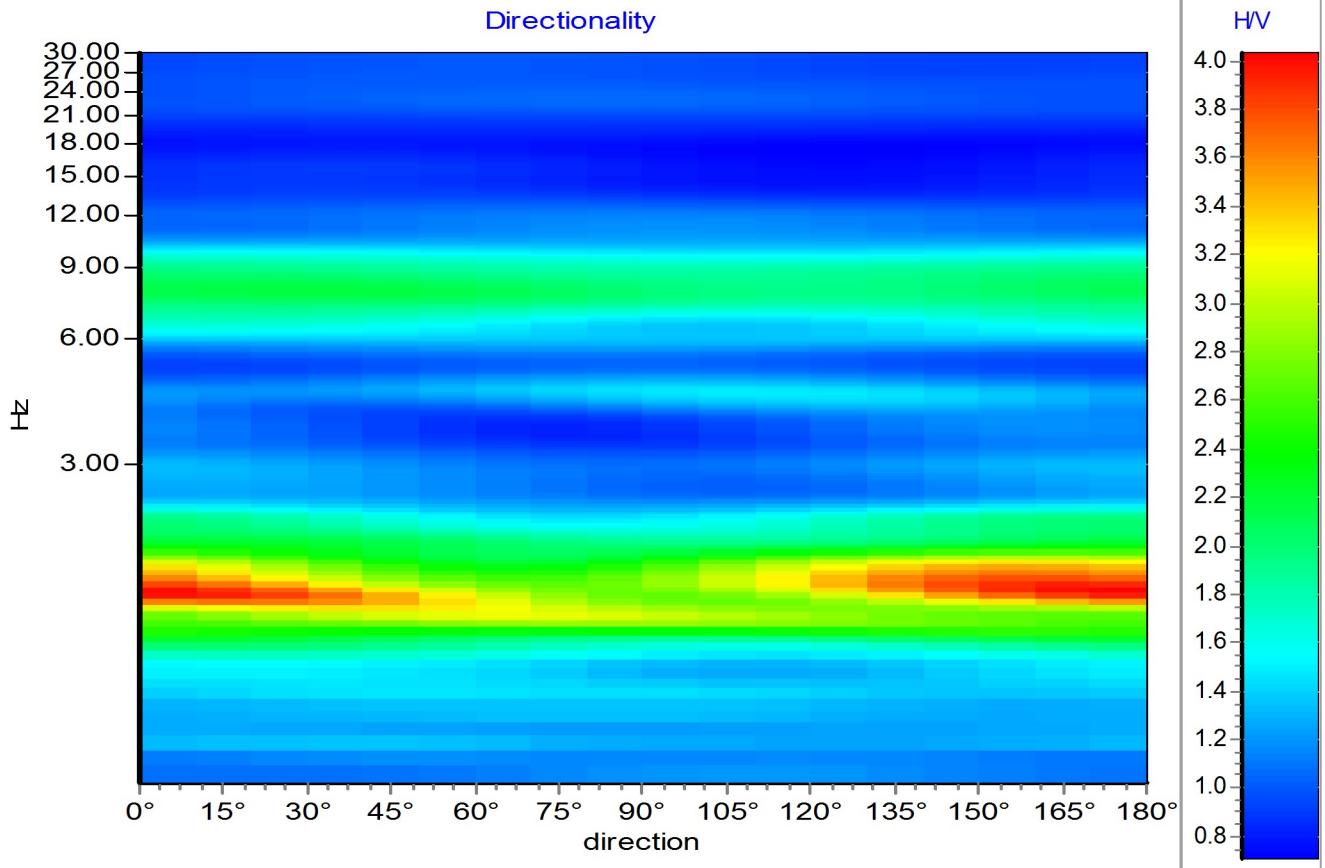
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **50 Ferrovia**





Misura 51 HVRS

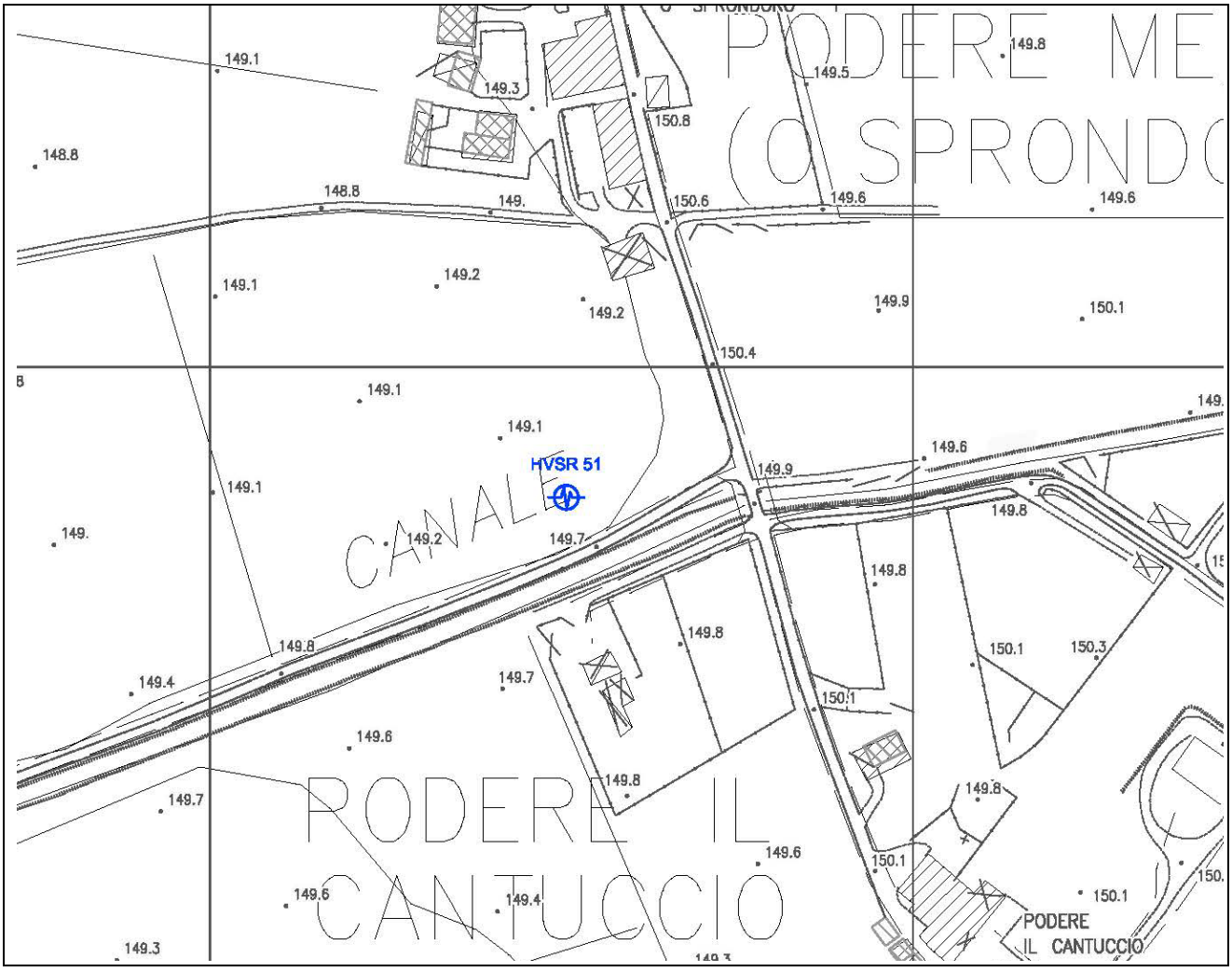


Figura 22.1 – individuazione del sito di studio - scala 1:2.000

Figura 22.2: rilievo sismico

H/V Spectral ratio

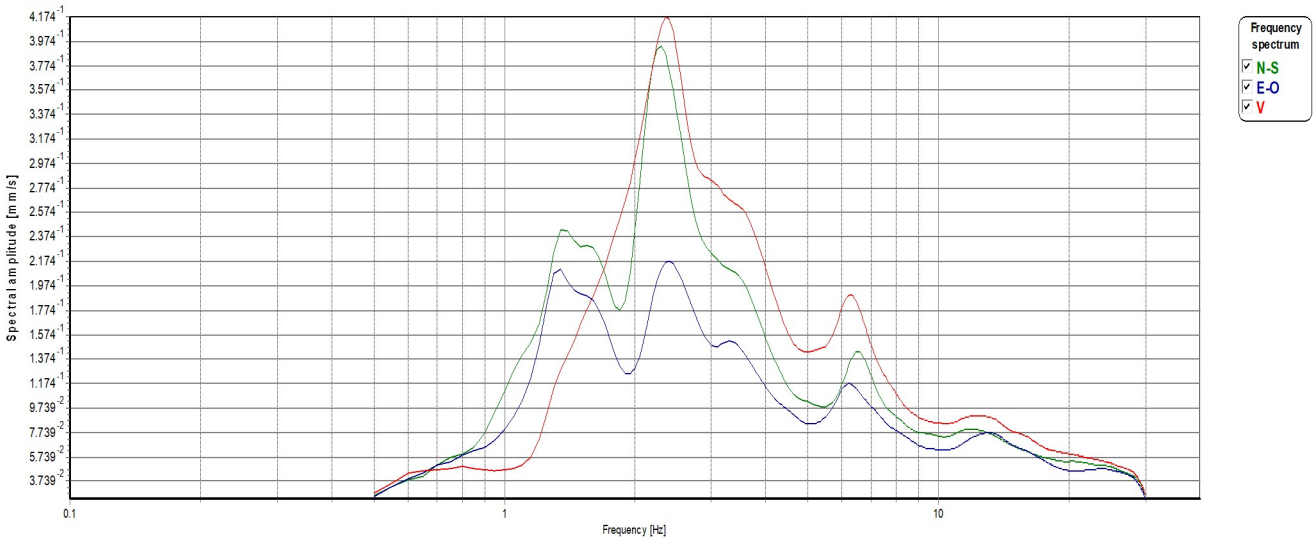
Analysis site: **Montevarchi**

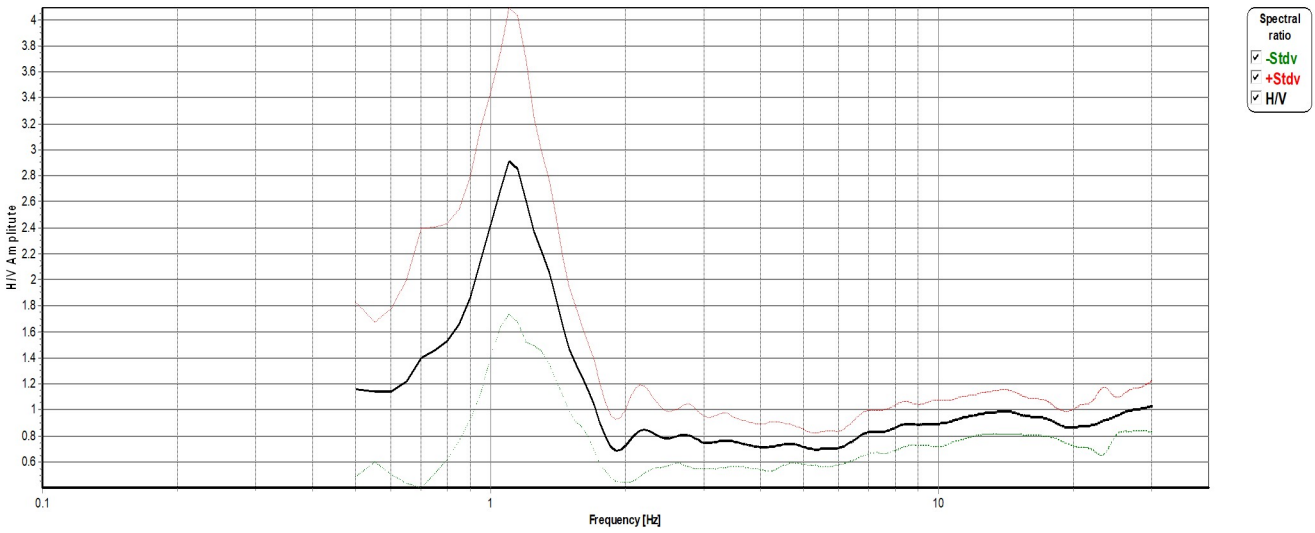
Measure point: **51 Podere Sprondoro 1**

Note: Montevarchi

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**12/08/2021 10:14:27**
Automatic spike removal:	**No**	Stop recordings:	**12/08/2021 10:54:27**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**111**
Lw Windows [s]:	**20**	Recording length [s]:	**2400**
Overlap Windows s]:	**0.0**	Discarded windows:	**9**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.068**	Standard deviation [Hz]:	**0.168**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **51 Podere Sprondoro 1**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.07 >= 0.50**	**Yes**
Nc(fø) > 200	**2371.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 32**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**1.600**	**Yes**
Aø > 2	**2.69 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**2.99% < 5.00%**	**Yes**
sf < e(fø)	**0.1678 > 0.1068**	**No**
sA(fø) < ?(fø)	**1.0536 < 1.7800**	**Yes**

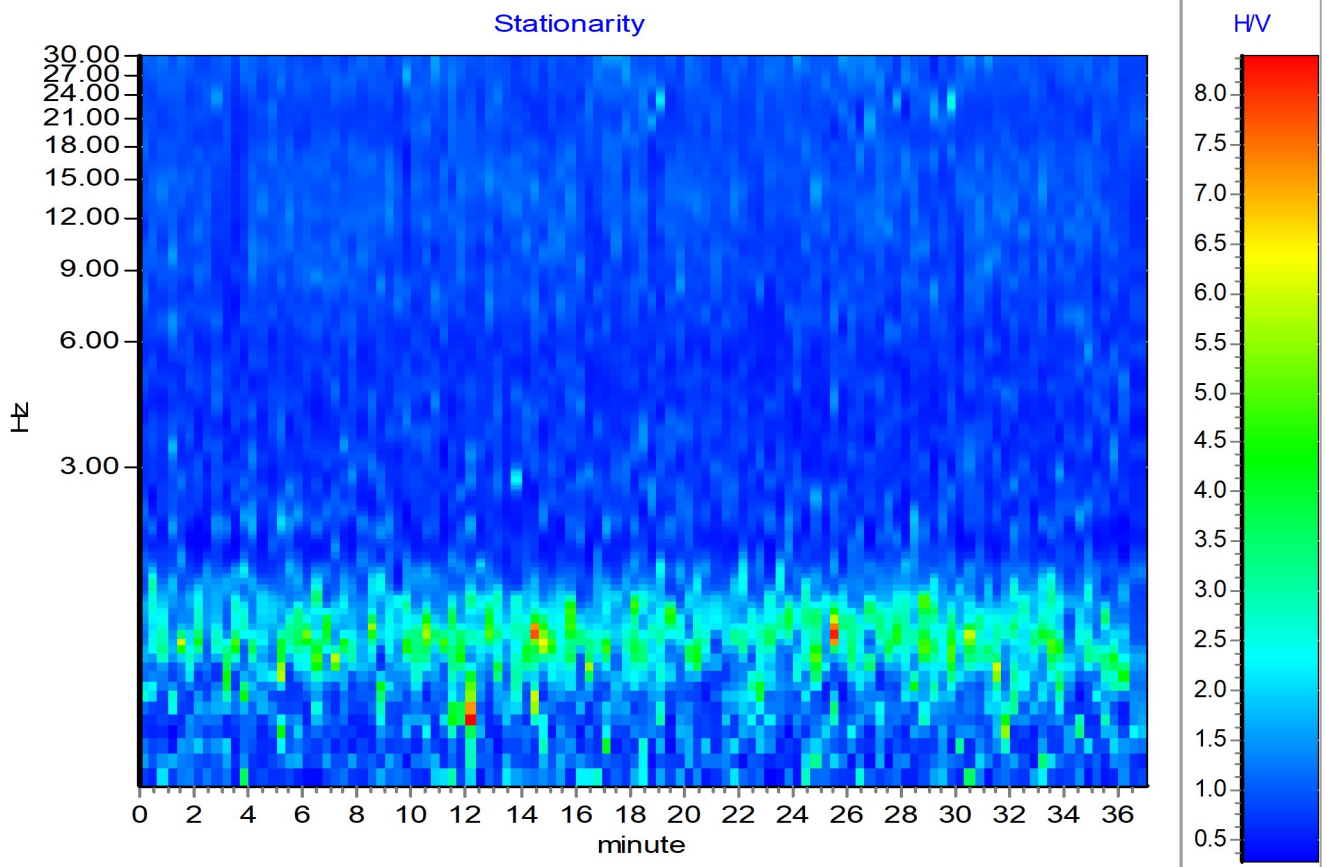
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

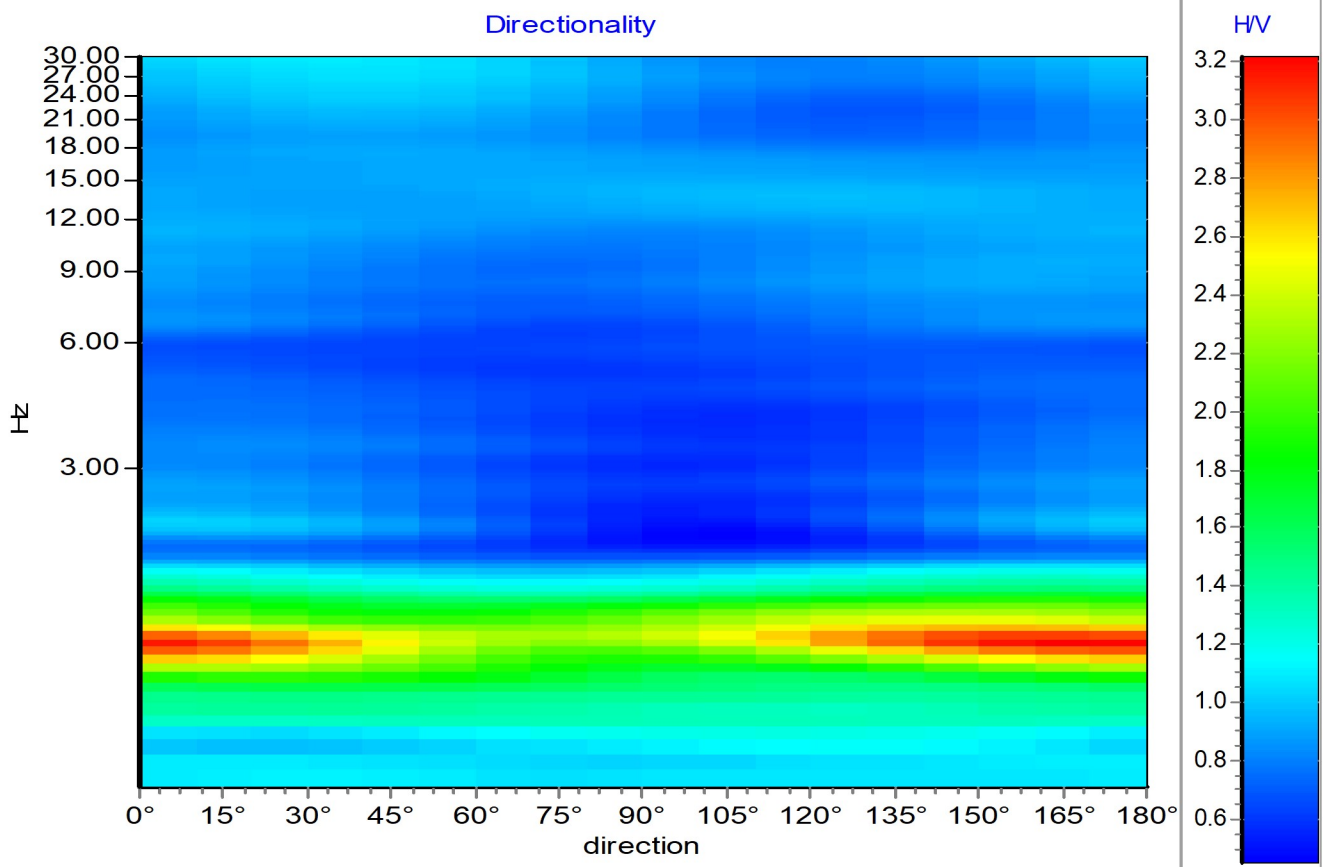
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **51 Podere Sprondoro 1**





Misura 52 HVRS

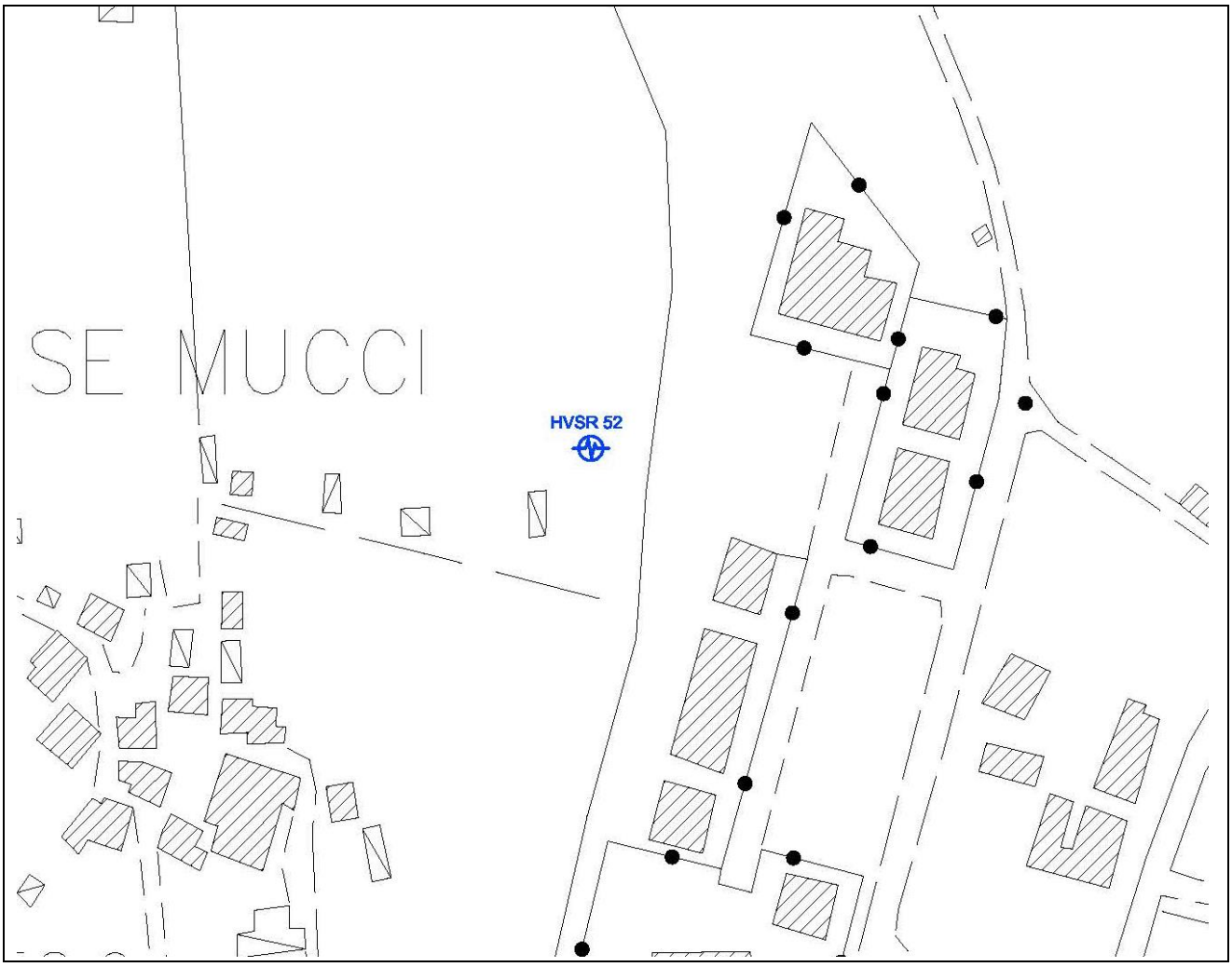


Figura 23.1 – individuazione del sito di studio - scala 1:2.000

Figura 23.2: rilievo sismico

H/V Spectral ratio

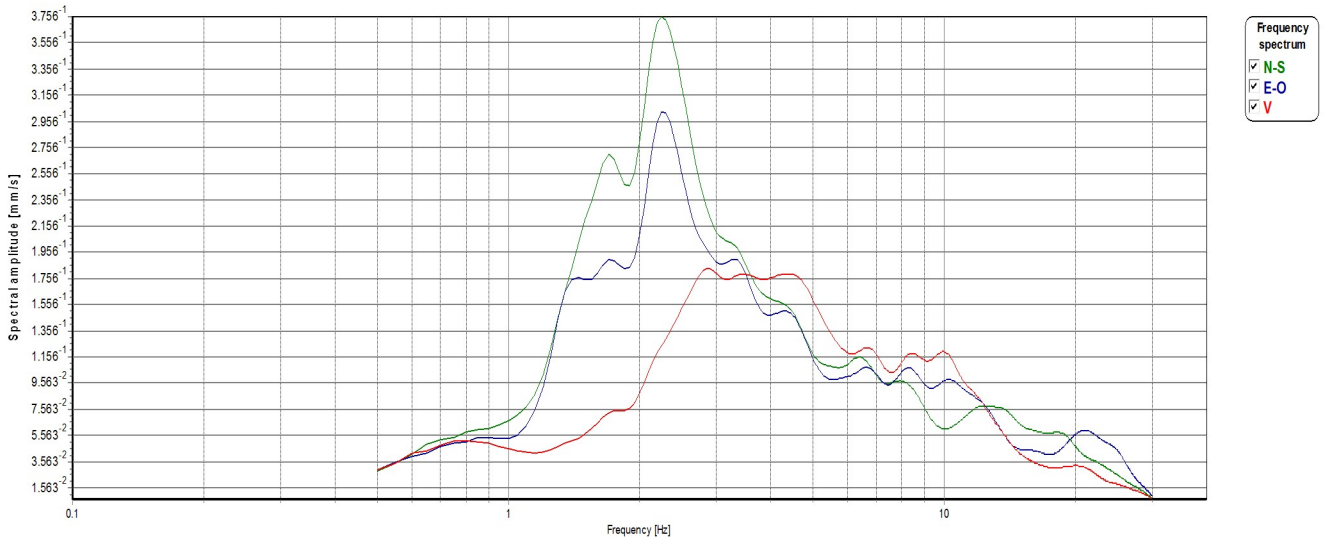
Analysis site: **Montevarchi**

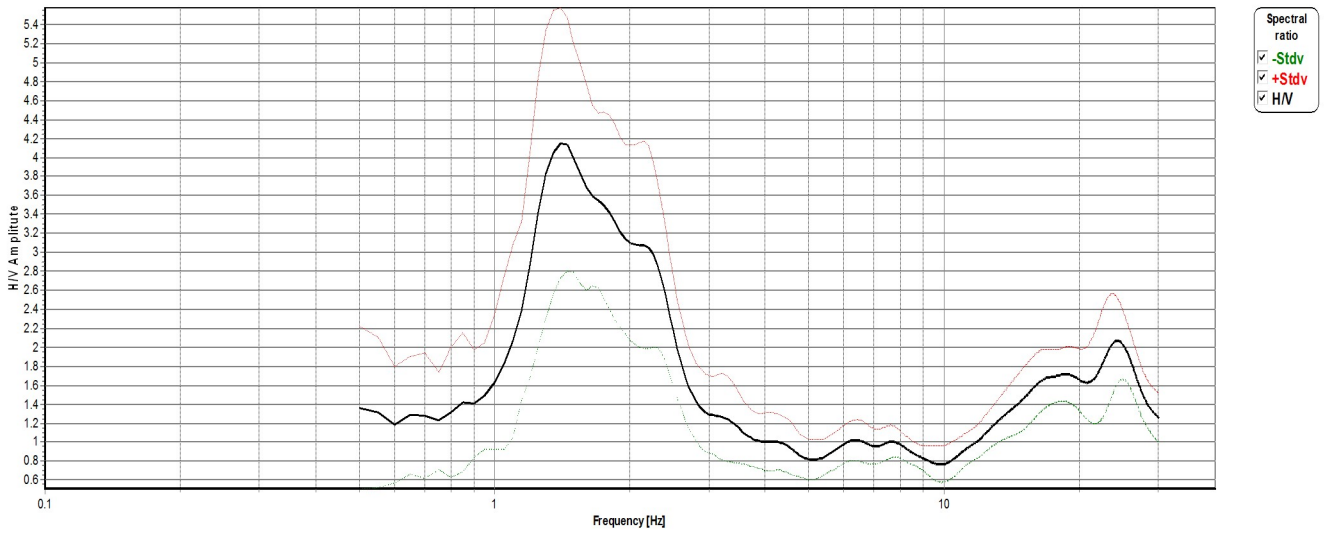
Measure point: **52 Stadio**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 09:42:30**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 10:17:30**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**88**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**17**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.565**	Standard deviation [Hz]:	**0.262**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **52 Stadio**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.57 >= 0.50**	**Yes**
Nc(fø) > 200	**2755.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 47**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.600**	**Yes**
Aø > 2	**3.83 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**10.56% > 5.00%**	**No**
sf < e(fø)	**0.2625 > 0.1565**	**No**
sA(fø) < ?(fø)	**1.1574 < 1.7800**	**Yes**

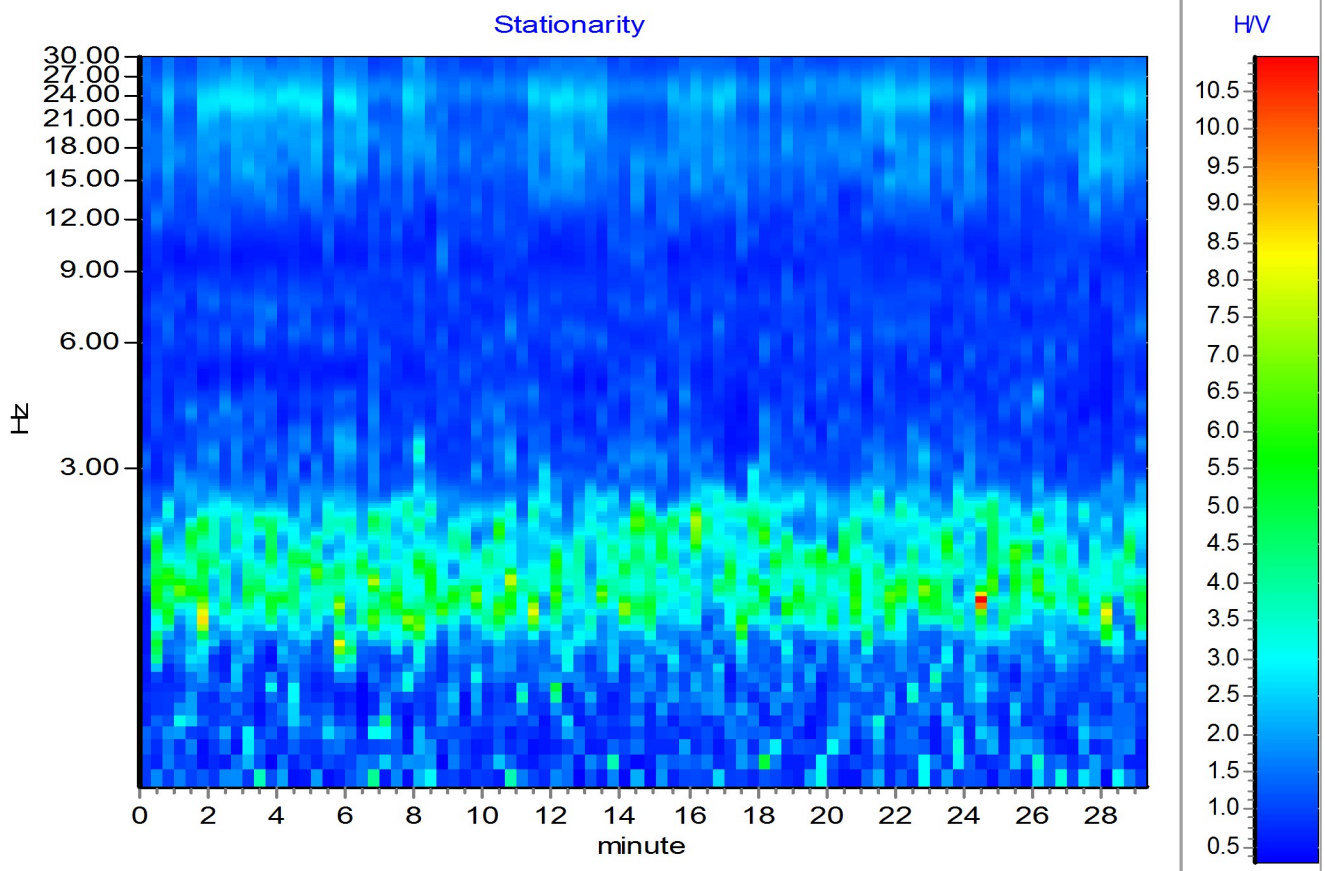
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

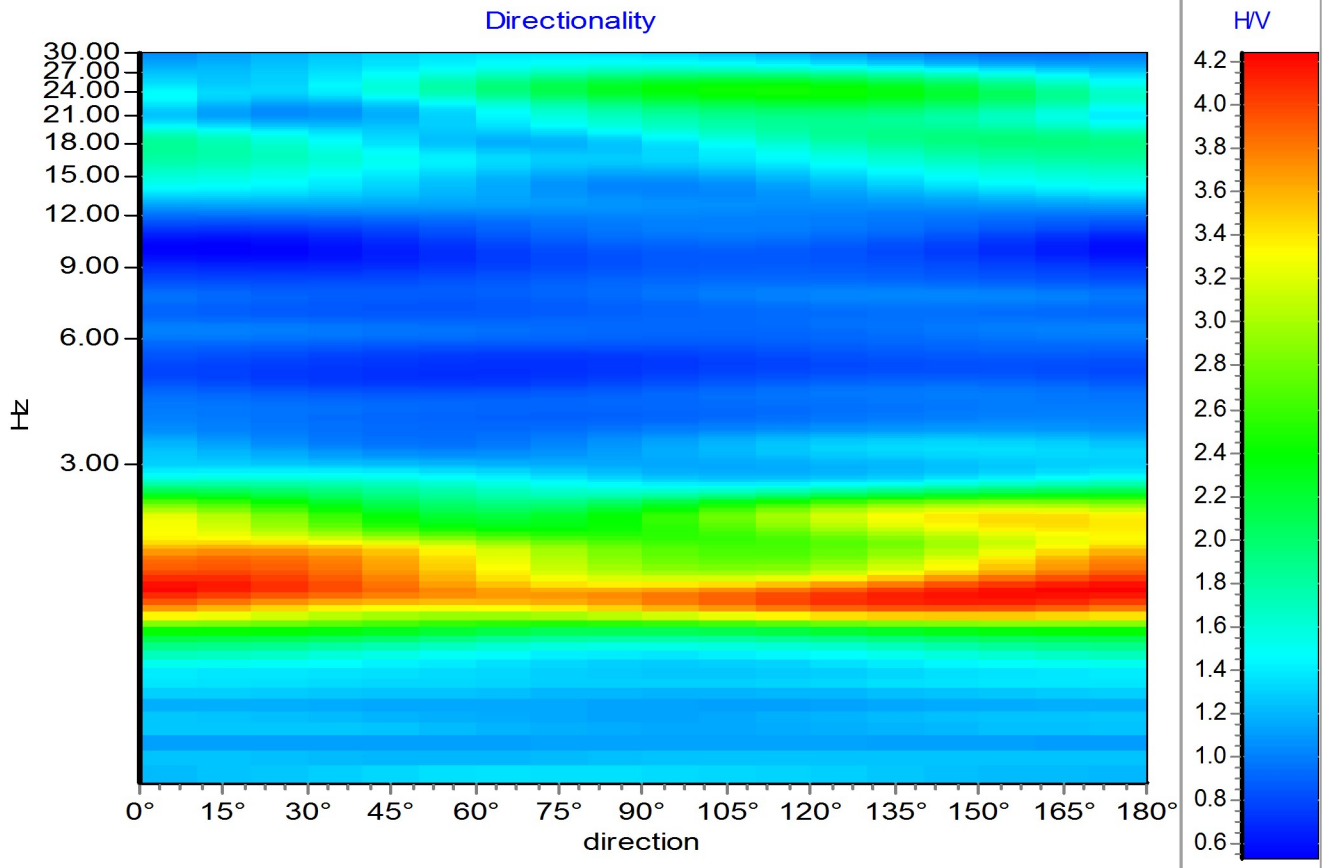
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **52 Stadio**





Misura 53 HVRS

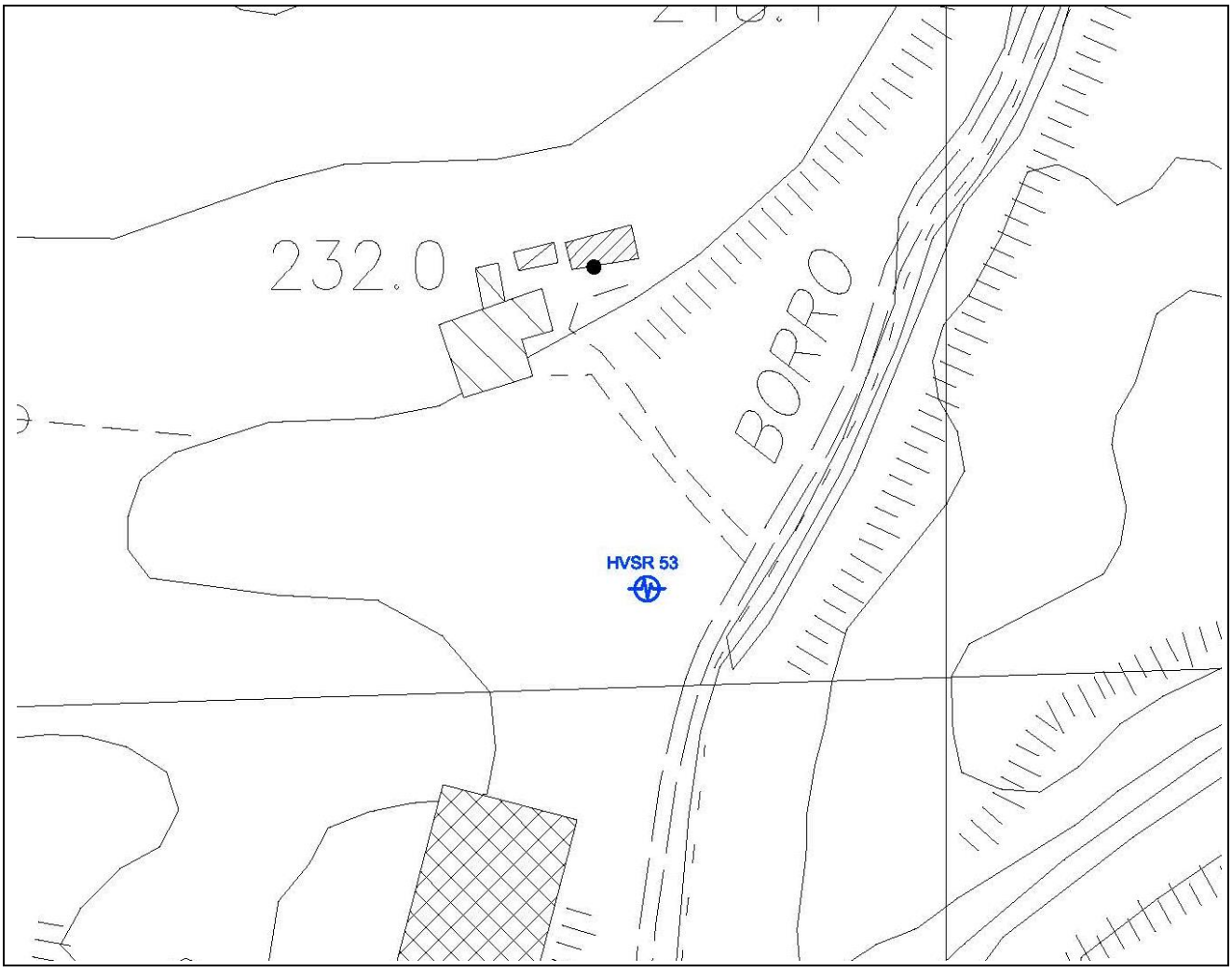


Figura 24.1 – individuazione del sito di studio - scala 1:2.000

Figura 24.2: rilievo sismico

H/V Spectral ratio

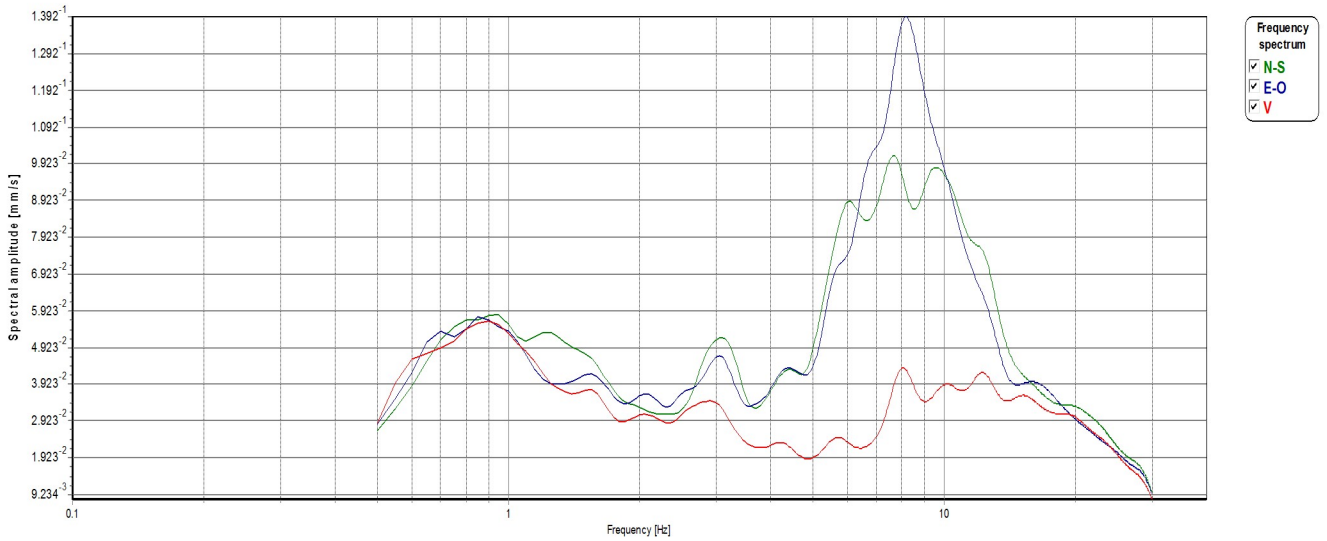
Analysis site: **Montevarchi**

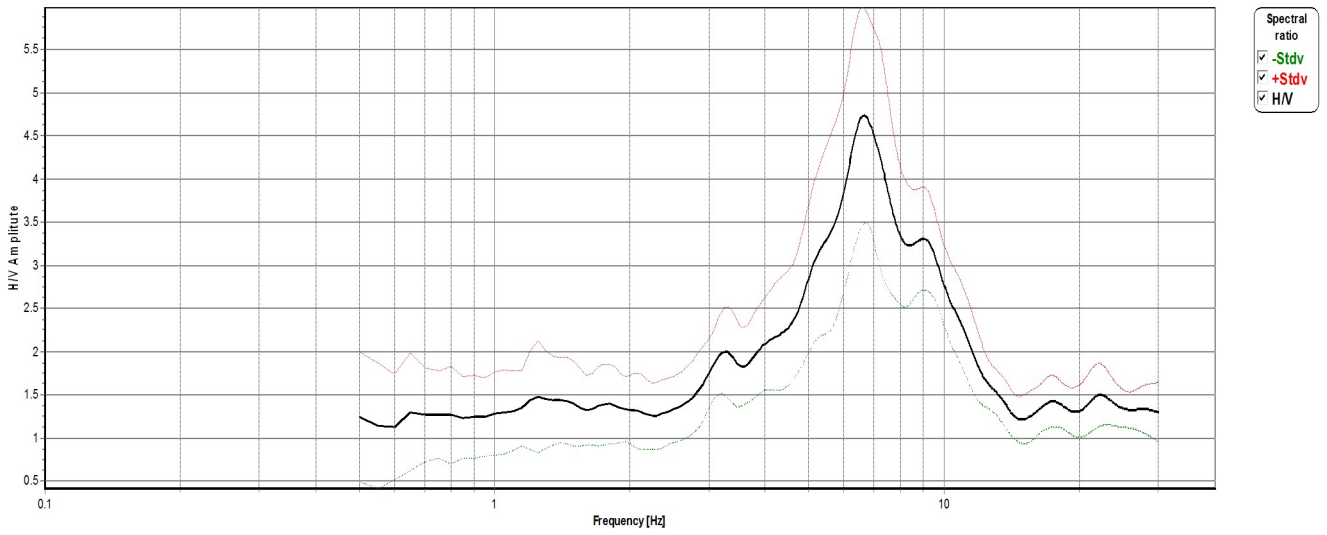
Measure point: **53 Casa del Vento**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 10:50:06**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 11:25:06**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**87**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**18**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**6.871**	Standard deviation [Hz]:	**2.548**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **53 Casa del Vento**

Criteria for a reliable H/V curve		
fø > 10/Lw	**6.87 >= 0.50**	**Yes**
Nc(fø) > 200	**11956.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 206**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**1.750**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**10.950**	**Yes**
Aø > 2	**4.63 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**4.68% < 5.00%**	**Yes**
sf < e(fø)	**2.5476 > 0.3436**	**No**
sA(fø) < ?(fø)	**1.2014 < 1.5800**	**Yes**

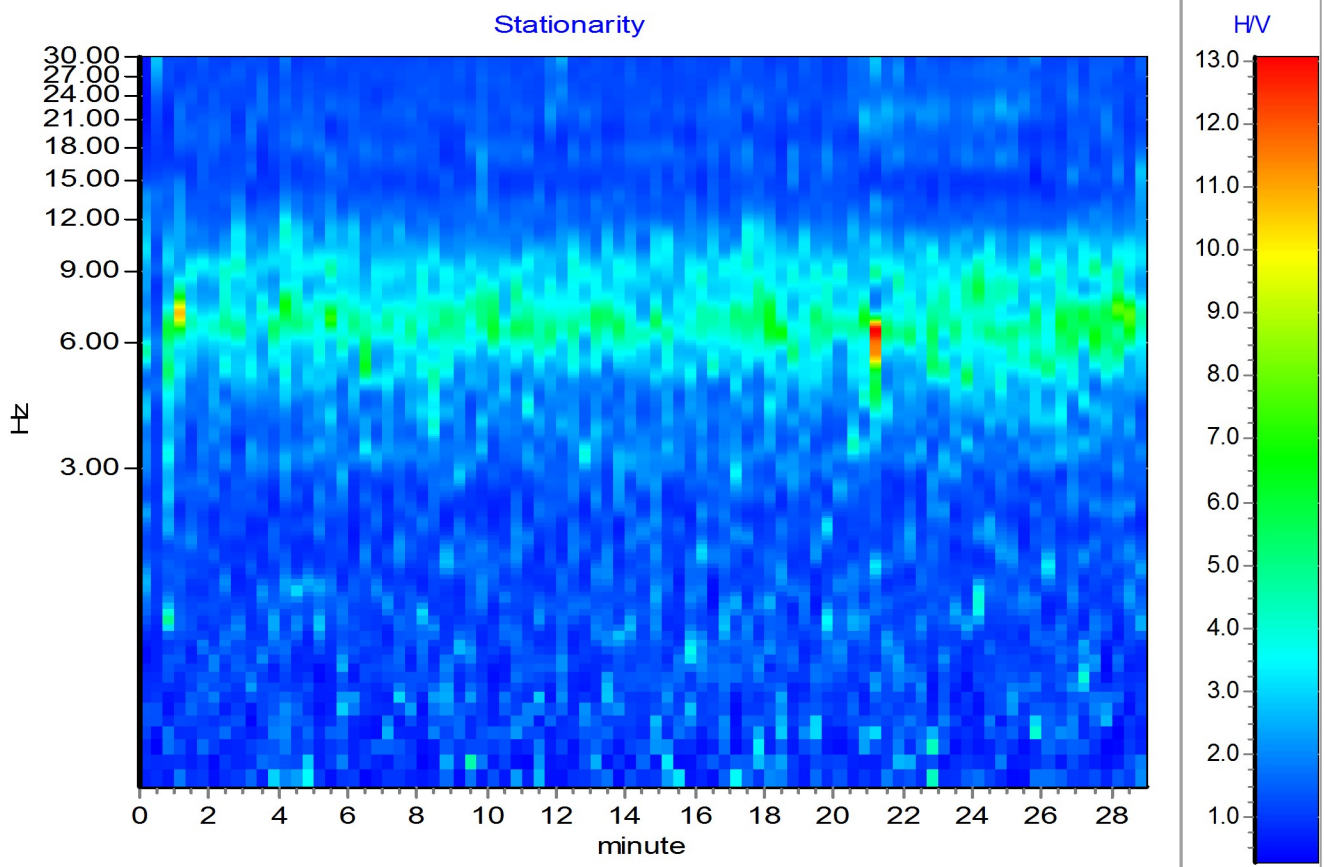
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

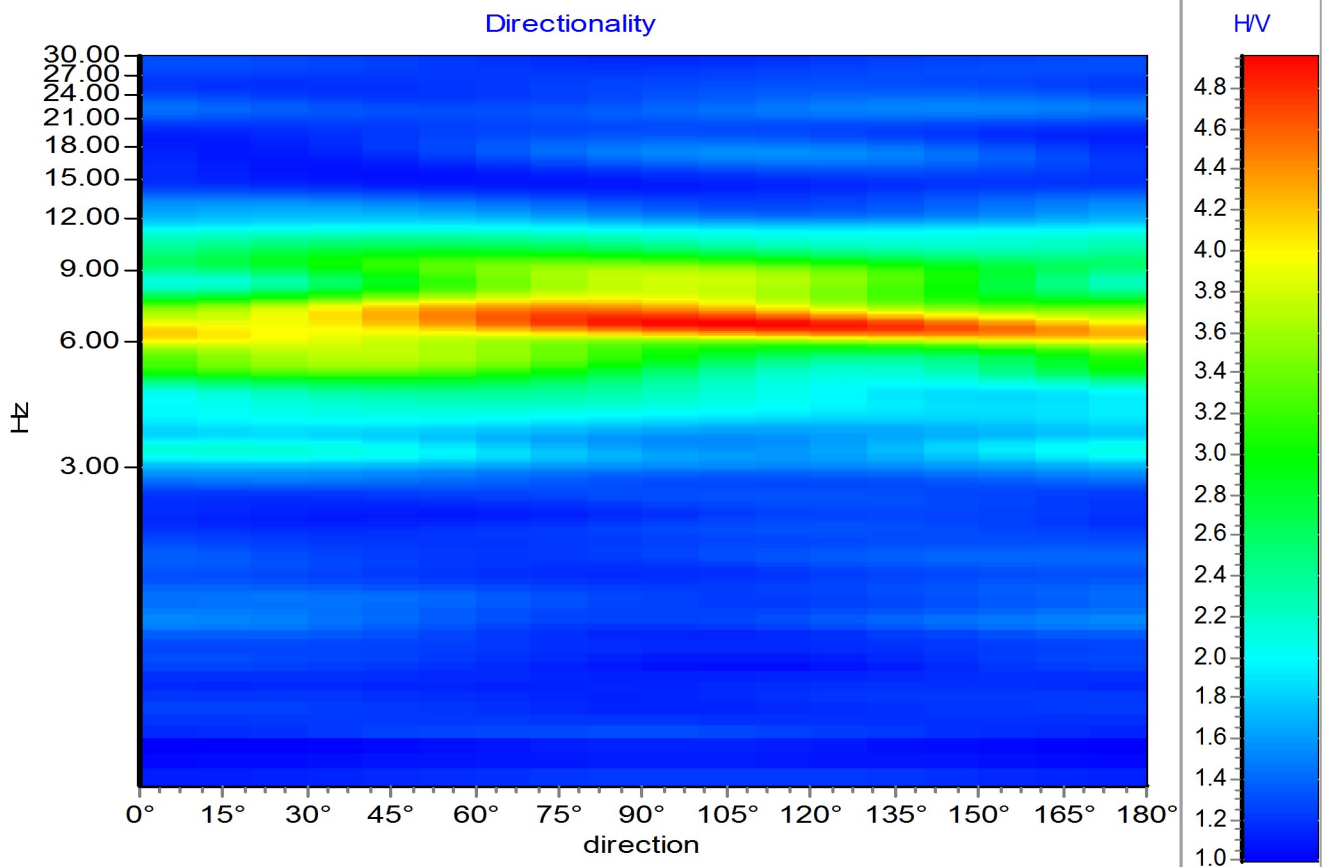
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **53 Casa del Vento**





Misura 54 HVRS

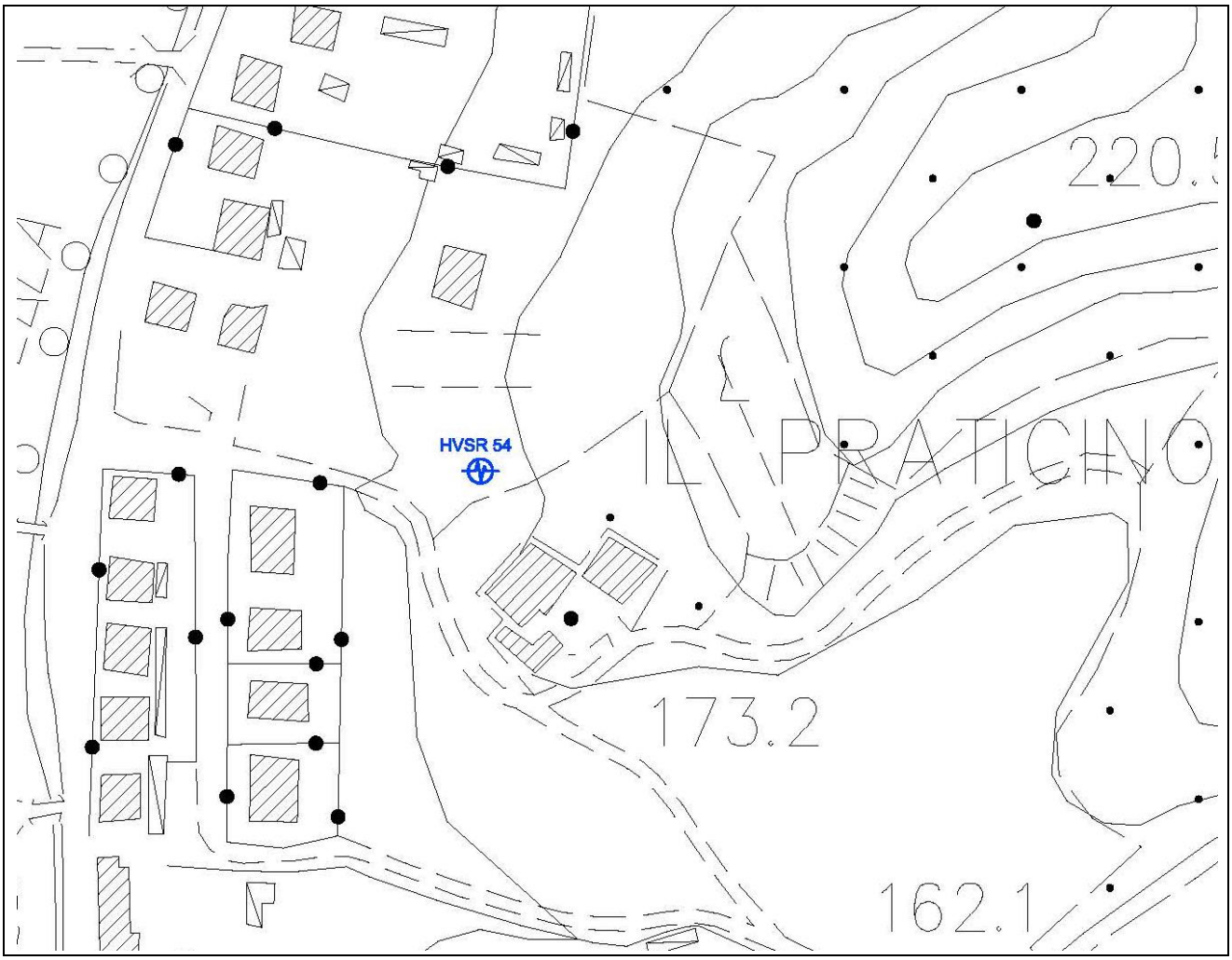


Figura 25.1 – individuazione del sito di studio - scala 1:2.000

Figura 25.2: rilievo sismico

H/V Spectral ratio

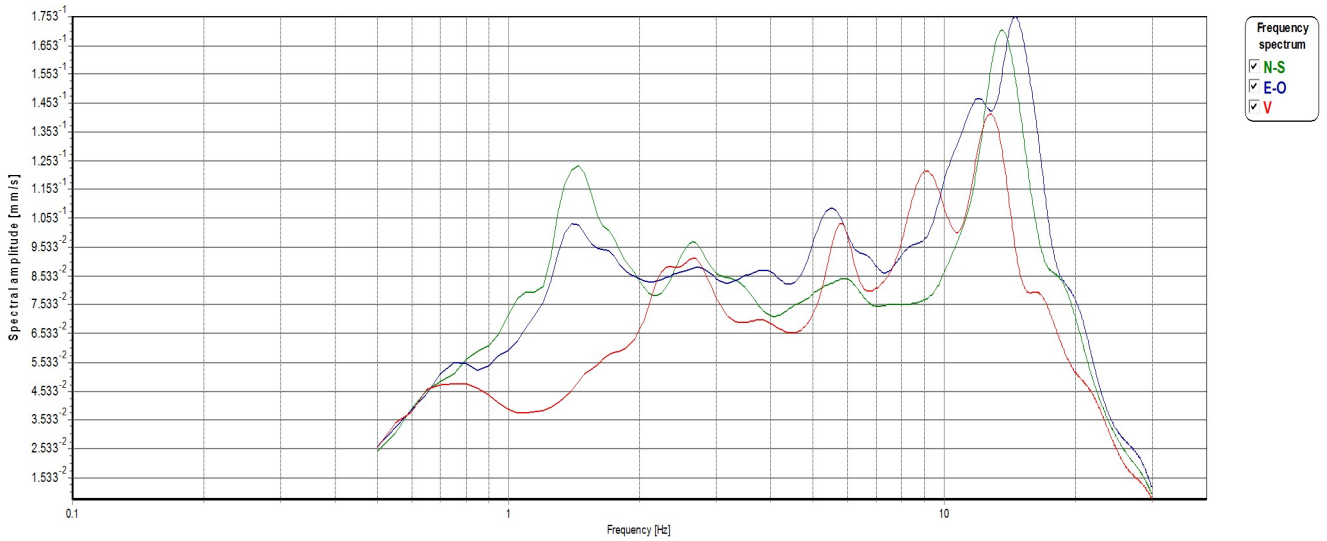
Analysis site: **Montevarchi**

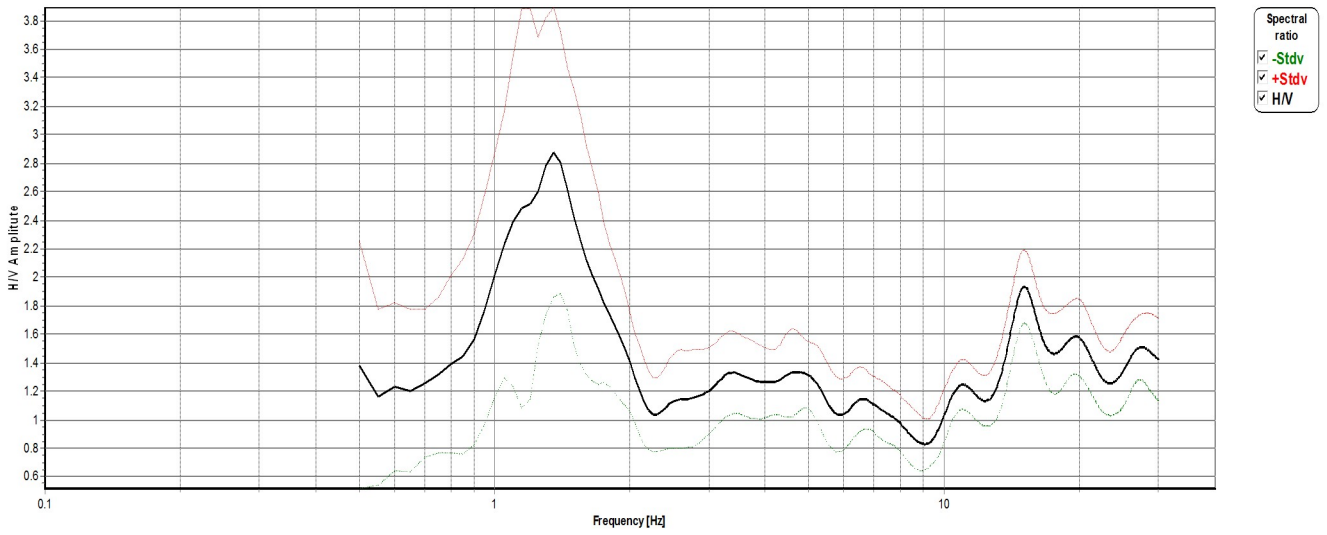
Measure point: **54 Patricino**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 18:05:39**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 18:40:39**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**87**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**18**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**1.282**	Standard deviation [Hz]:	**0.192**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **54 Patricino**

Criteria for a reliable H/V curve		
fø > 10/Lw	**1.28 >= 0.50**	**Yes**
Nc(fø) > 200	**2231.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 39**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.500**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**2.050**	**Yes**
Aø > 2	**2.78 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**9.19% > 5.00%**	**No**
sf < e(fø)	**0.1919 > 0.1282**	**No**
sA(fø) < ?(fø)	**1.0425 < 1.7800**	**Yes**

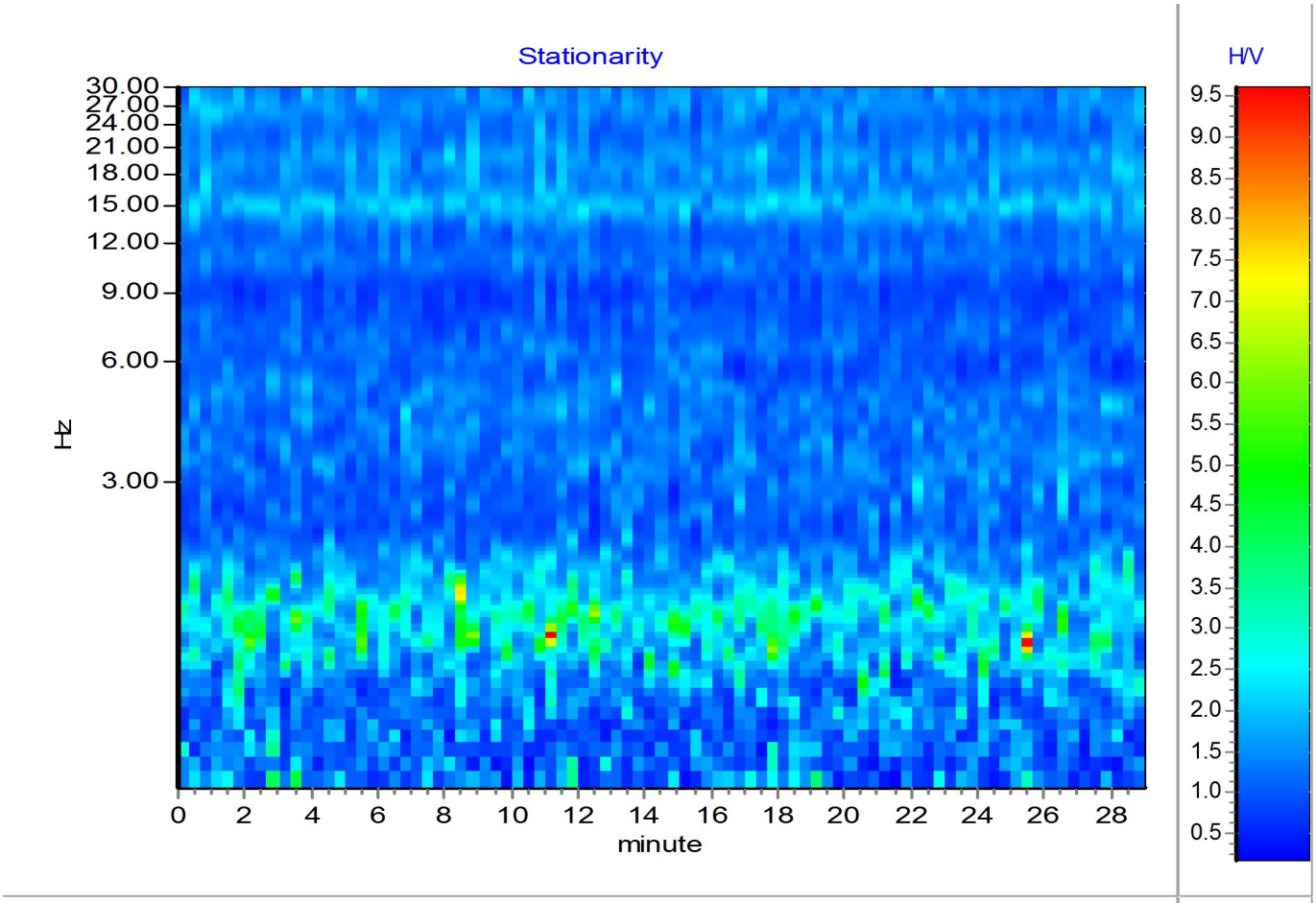
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

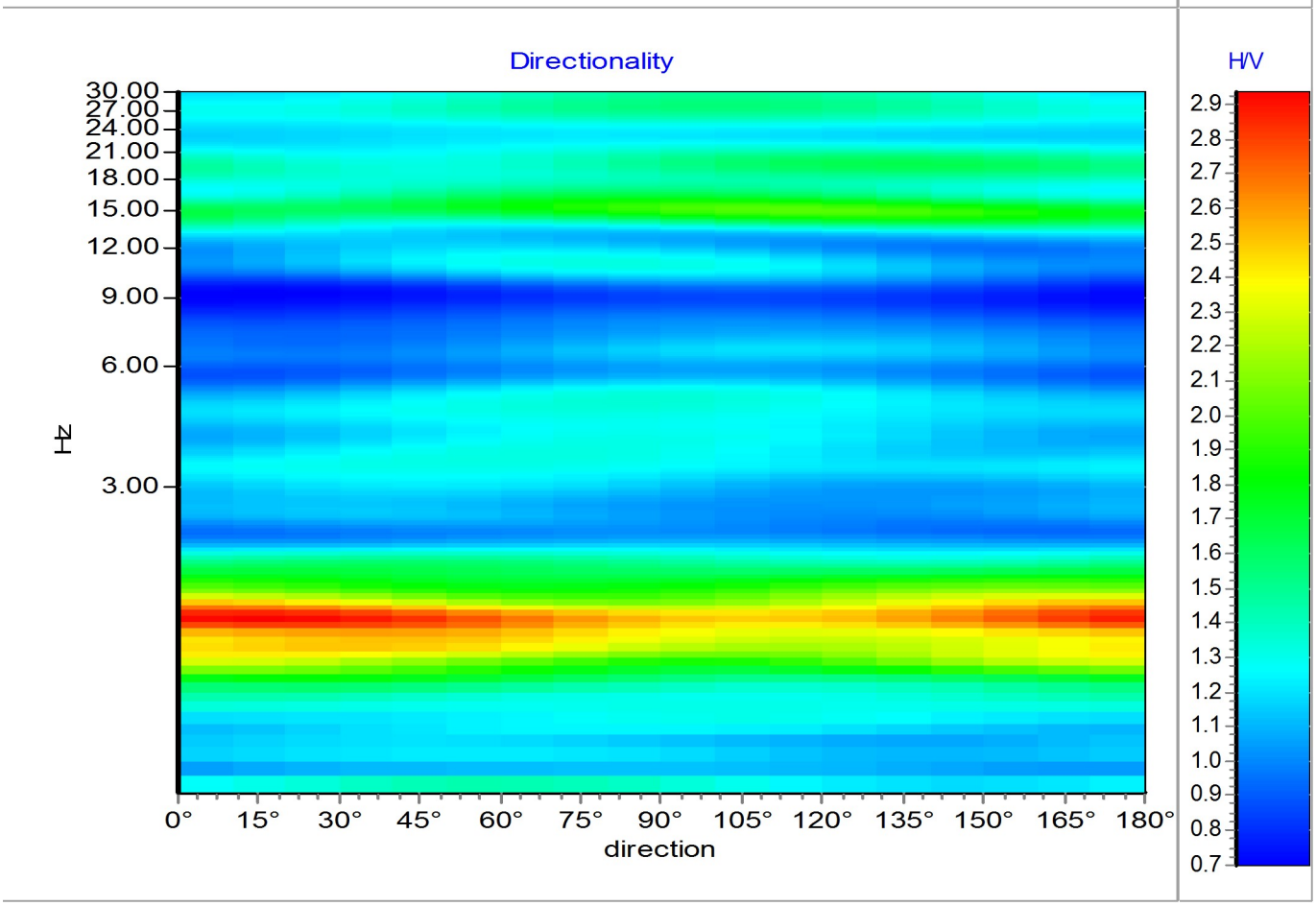
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **54 Patricino**





Misura 55 HVRS

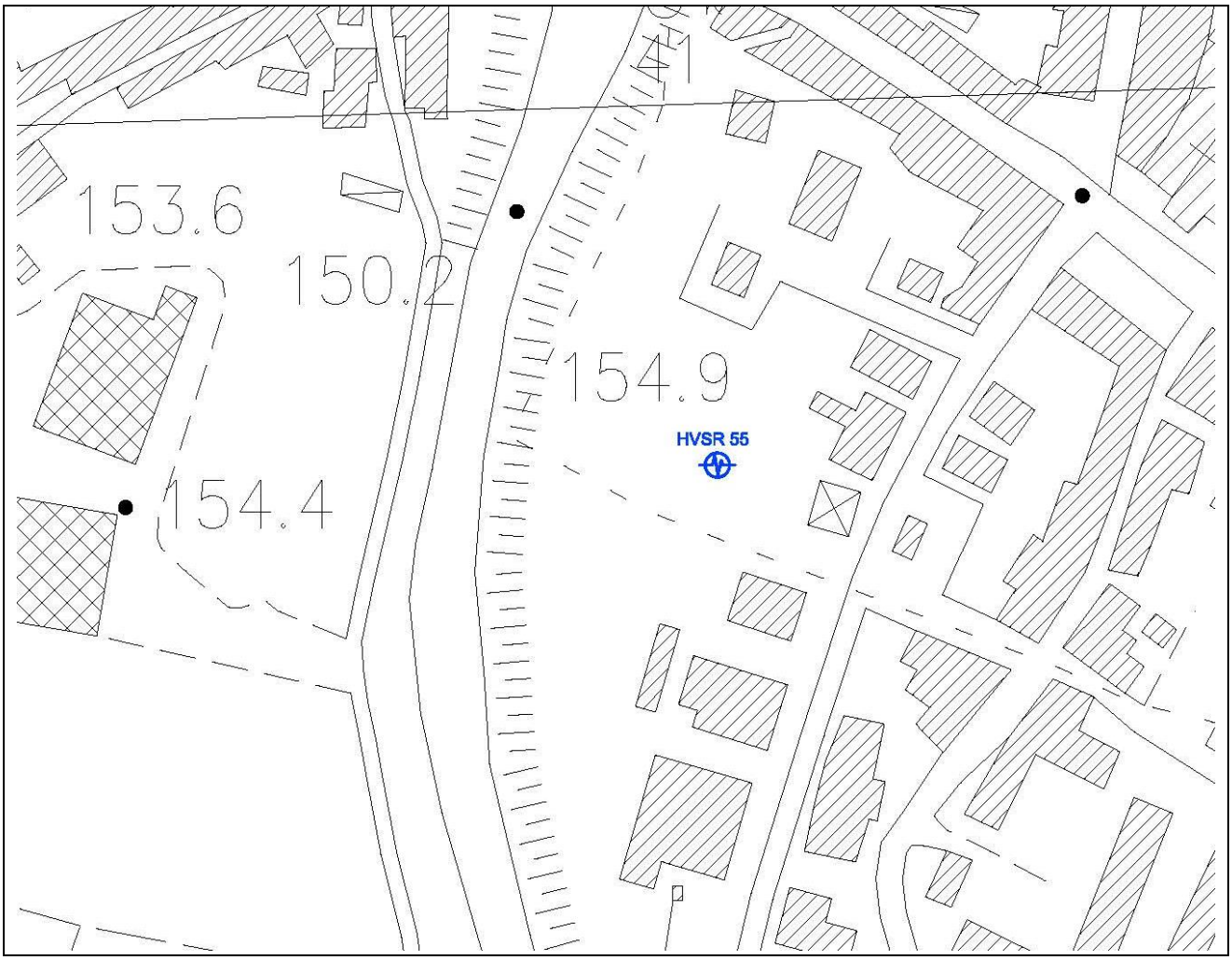


Figura 26.1 – individuazione del sito di studio - scala 1:2.000

Figura 26.2: rilievo sismico

H/V Spectral ratio

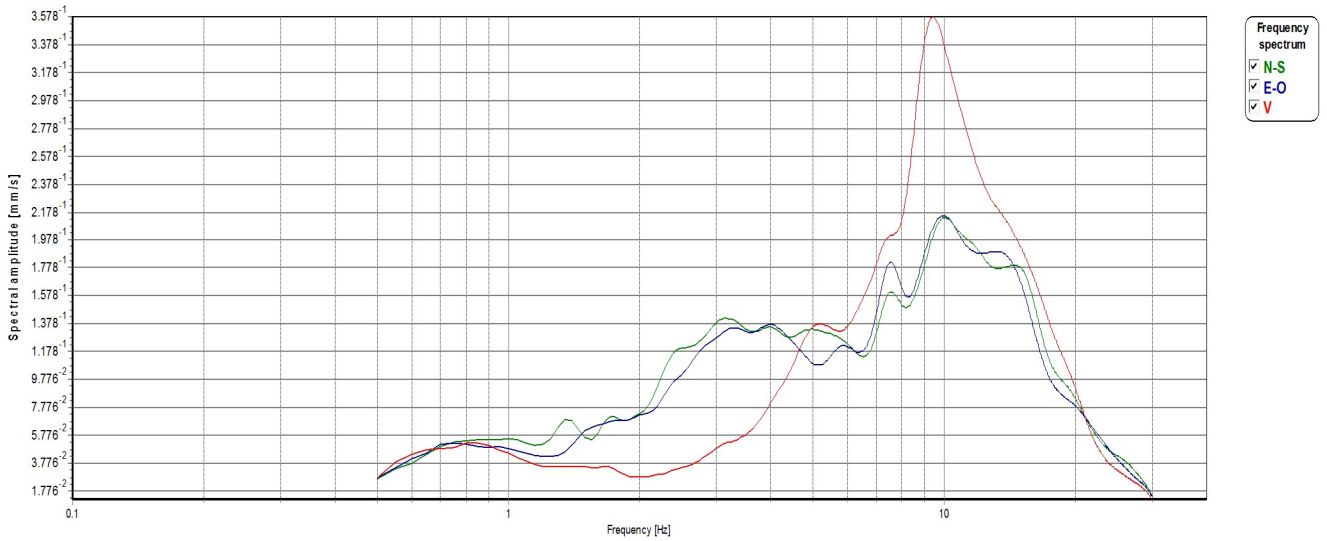
Analysis site: **Montevarchi**

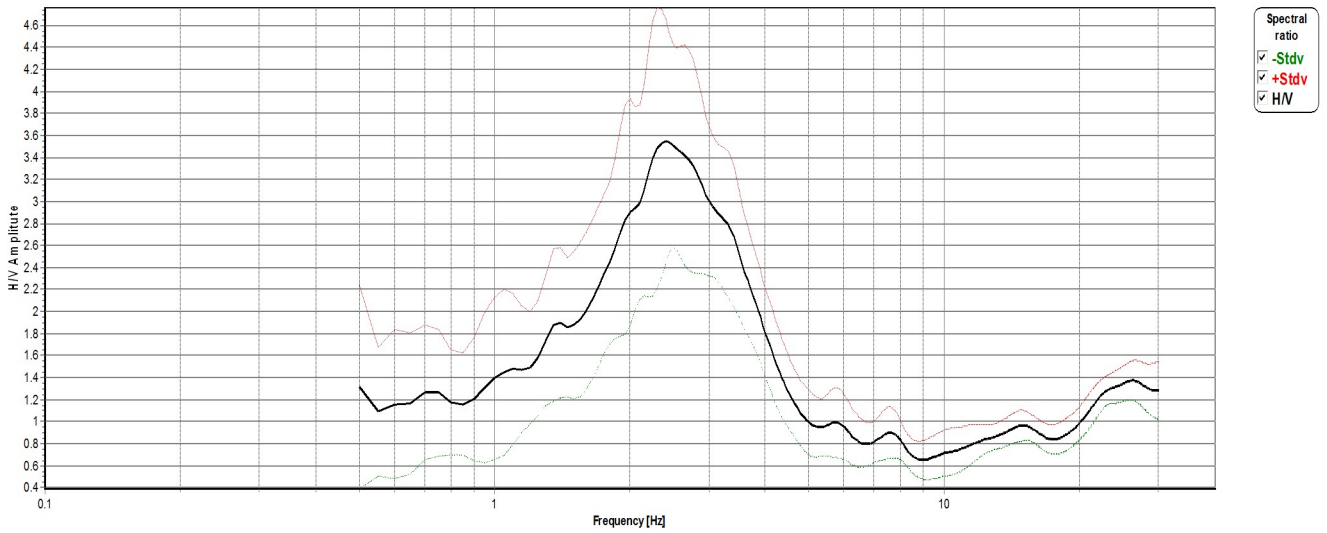
Measure point: **55 Levane**

Note:

Analysis parameters			
Sample frequency [Hz]:	**250.00**	Start recordings:	**03/05/2021 11:44:30**
Automatic spike removal:	**No**	Stop recordings:	**03/05/2021 12:19:30**
LTA [s]:	**5.0**	High pass frequency [Hz]:	**0.50**
STA [s]:	**0.5**	Low pass frequency [Hz]:	**30.00**
Ratio:	**1.9**	Nw number of windows:	**86**
Lw Windows [s]:	**20**	Recording length [s]:	**2100**
Overlap Windows s]:	**0.0**	Discarded windows:	**19**
Konno-Ohmachi parameter:	**40**		

Analysis results			
H/V peak frequency fø [Hz]:	**2.418**	Standard deviation [Hz]:	**0.366**





H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **55 Levane**

Criteria for a reliable H/V curve		
fø > 10/Lw	**2.42 >= 0.50**	**Yes**
Nc(fø) > 200	**4159.00 >= 200.00**	**Yes**
sA(f)<2 for 0.5fø<f<2fø	**exceeded 0 out of 72**	**Yes**
Criteria for a clear H/V peak		
Exists f in [fø/4,fø] where A(f) < Aø/2	**0.650**	**Yes**
Exists f in [fø,4fø] where A(f) < Aø/2	**4.050**	**Yes**
Aø > 2	**3.55 > 2.00**	**Yes**
Criteria for a stable H/V peak		
Fpeak[A(f)± sA(f)] = fø ± %	**4.88% < 5.00%**	**Yes**
sf < e(fø)	**0.3658 > 0.1209**	**No**
sA(fø) < ?(fø)	**1.1068 < 1.5800**	**Yes**

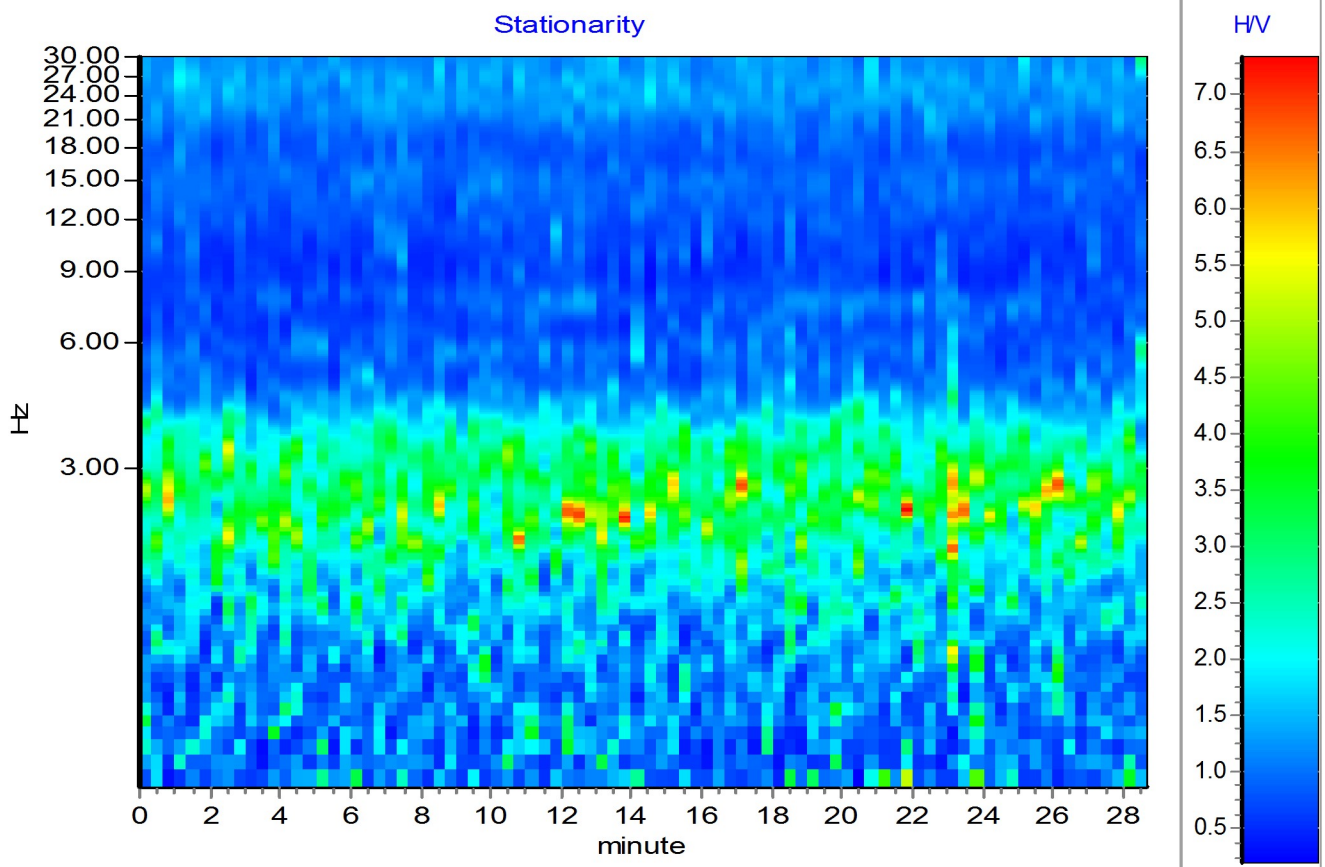
Lw	window length
Nw	number of windows used in the analysis
f	current frequency
fø	H/V peak frequency
sf	standard deviation of H/V peak frequency
Nc = fø x Lw x Nw	number of significant cycles
AH/V(f)	H/V curve amplitude at frequency f
Aø	H/V peak amplitude at frequency fø
sA(f)	standard deviation of AH/V(f)
sA(fø)	standard deviation of AH/V(f) at fø frequency
e(fø)	threshold value for the stability condition sf < e(fø)
?(fø)	threshold value for the stability condition sA(fø) < ?(fø)
Fpeak[A(f)± sA(f)] = fø ± %	maximum deviation from the fø peak, expressed as a percentage

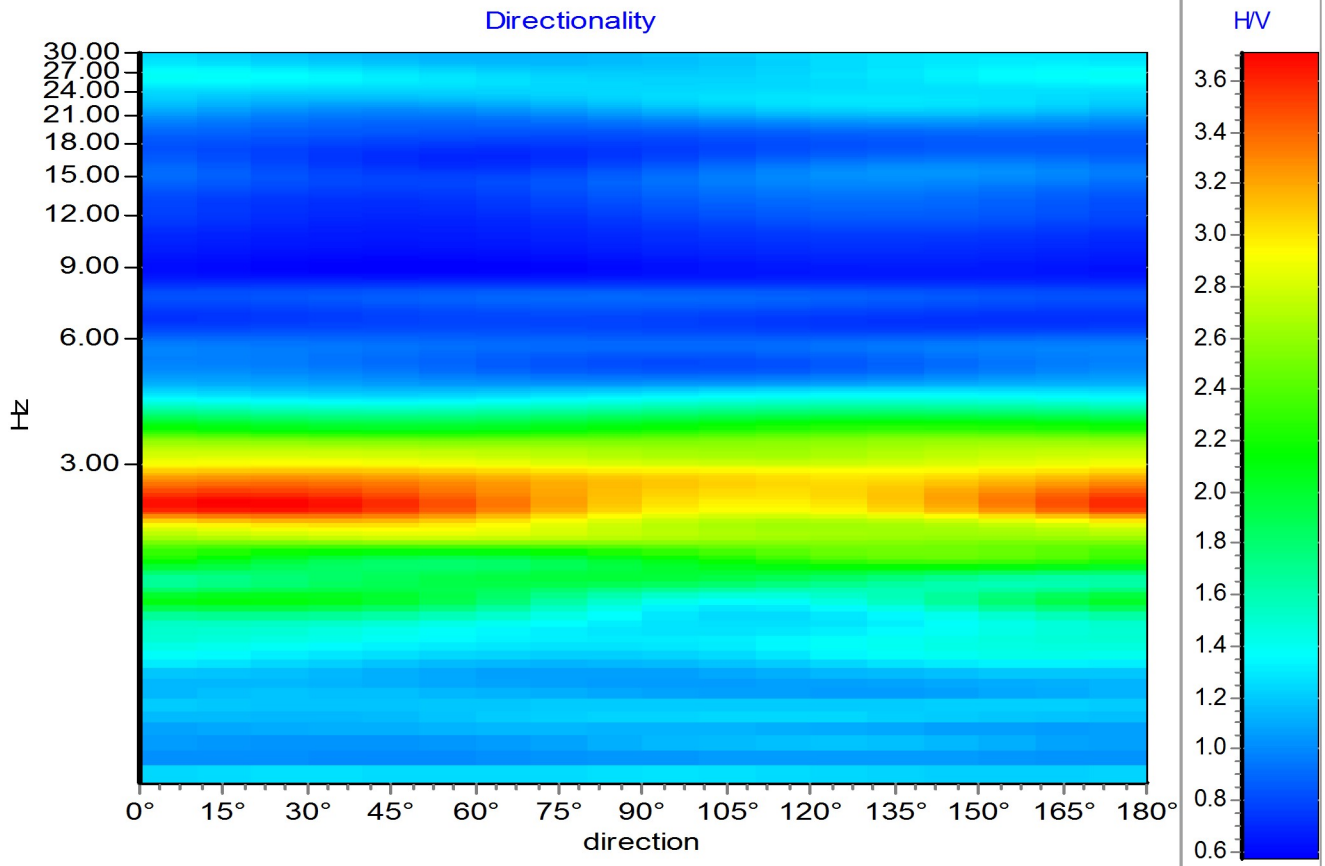
Threshold values for sf and sA(fø)					
fø frequency range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
e(fø) [Hz]	0.25fø	0.2fø	0.15fø	0.1fø	0.05fø
?(fø) for sA(fø)	3.0	2.5	2.0	1.78	1.58

H/V Spectral ratio

Analysis site: **Montevarchi**

Measure point: **55 Levane**





MASW 1

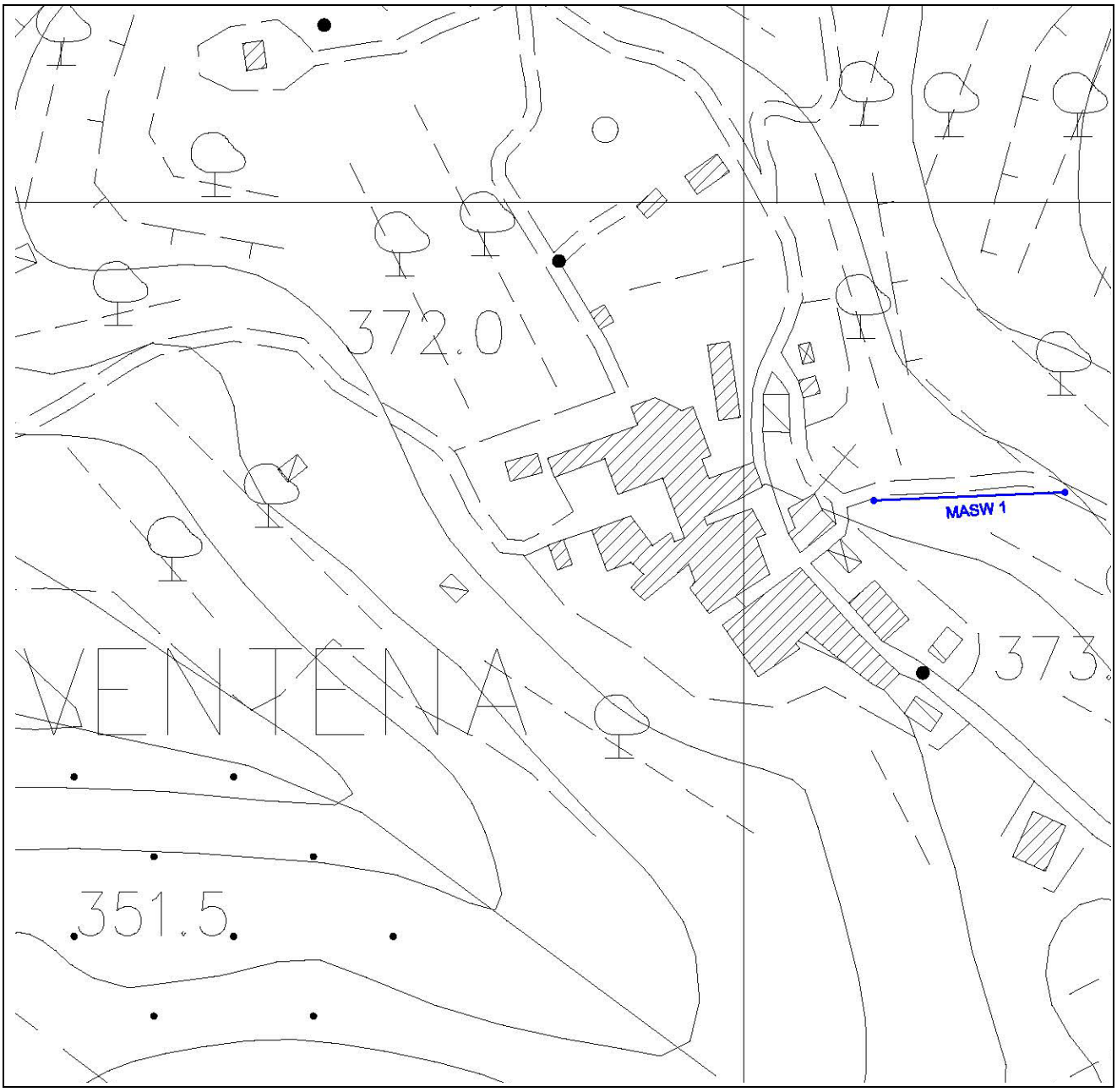


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

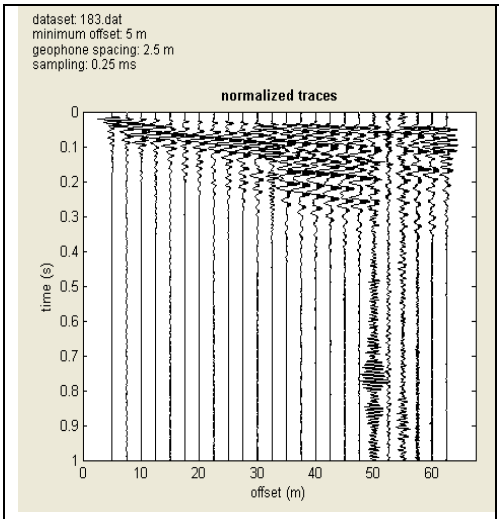


Figura: Sismogramma

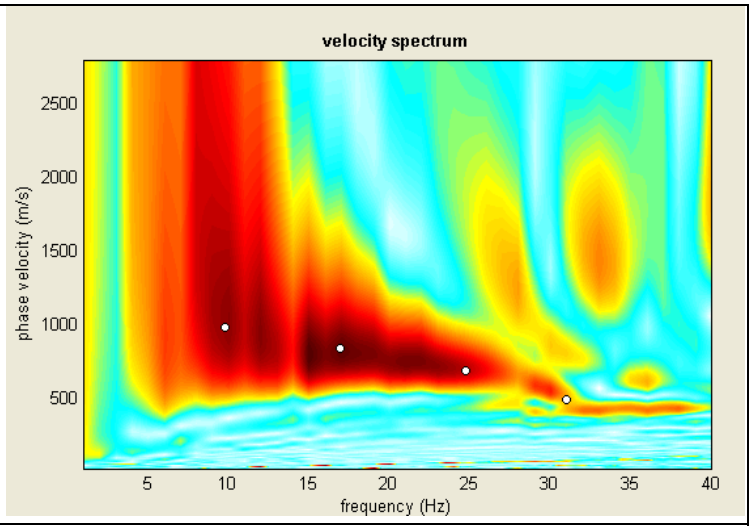
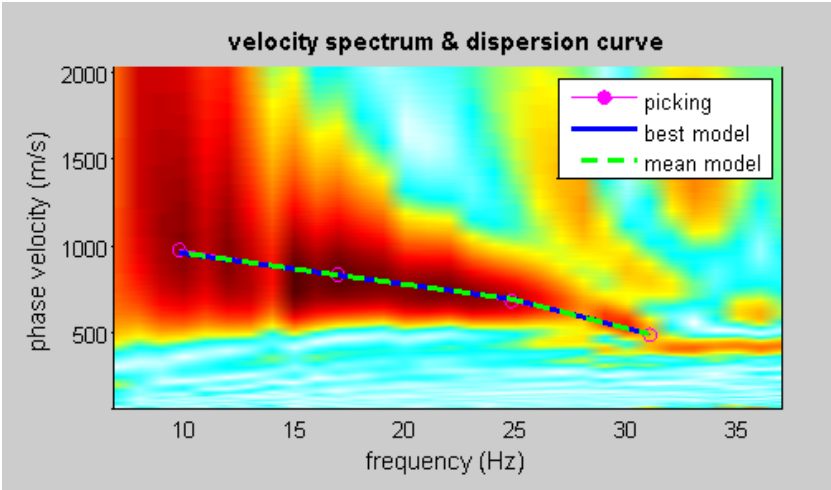


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 1

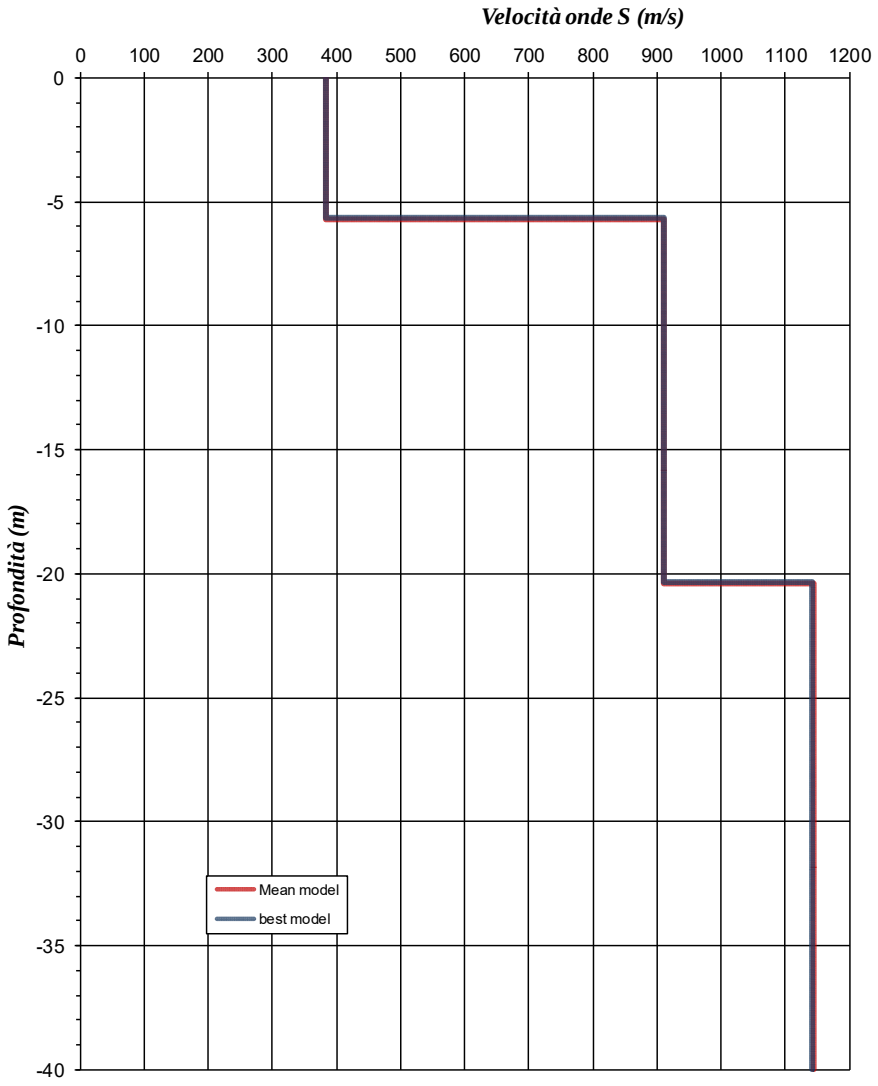


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW - 1					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	5,7	383	0	5,7	383
5,7	20,4	911	5,7	20,3	911
20,4	40	1145	20,3	40	1141
Vseq = 383 m/s			Vseq = 383 m/s		

MASW Montevarchi 2

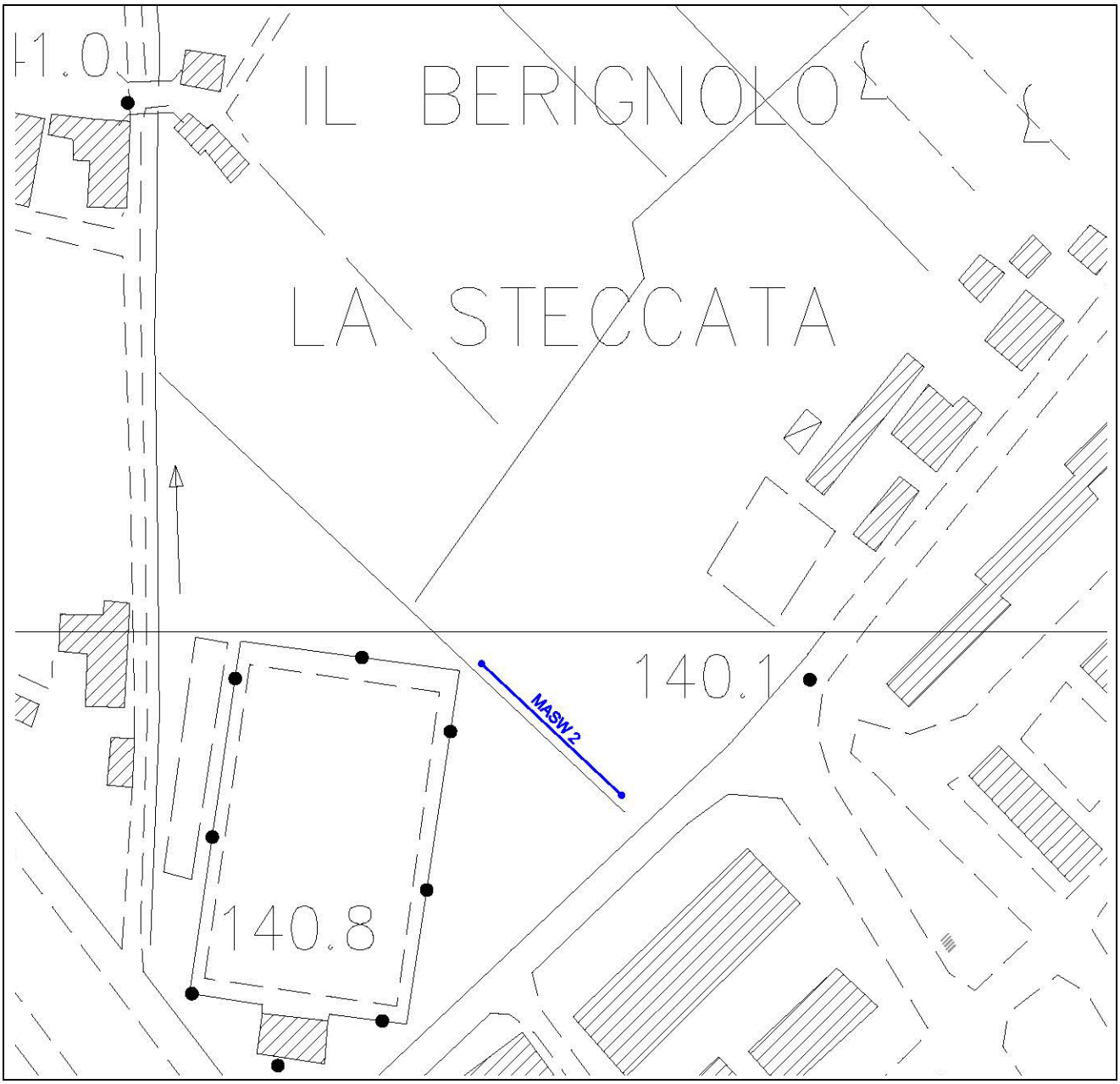


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

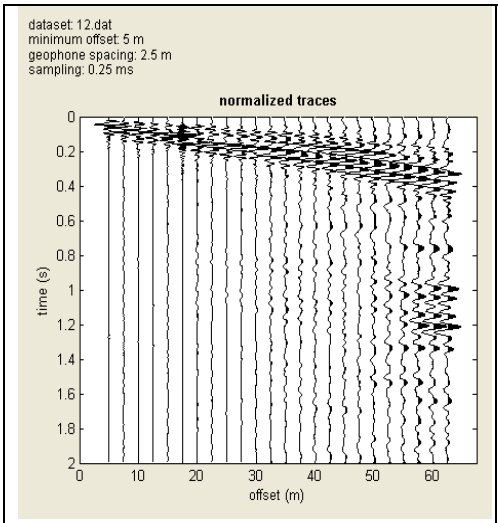


Figura: Sismogramma

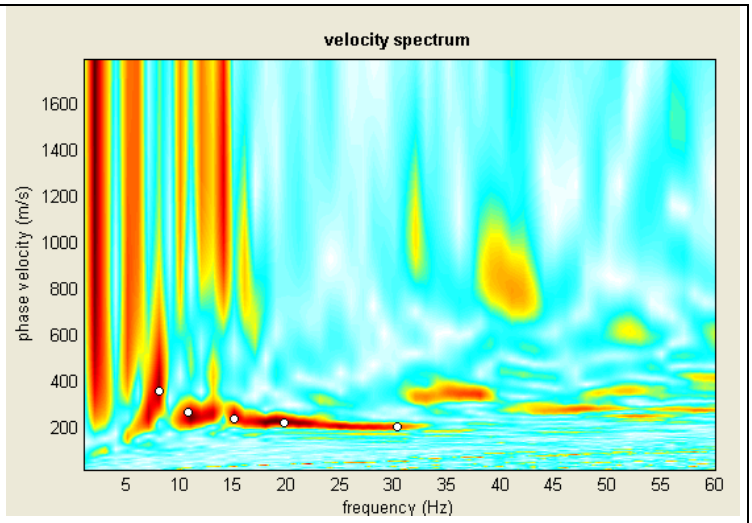
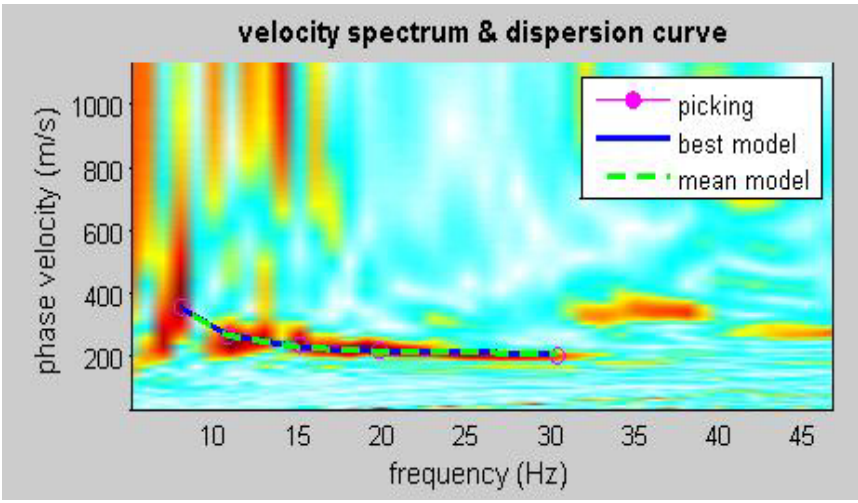


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 2

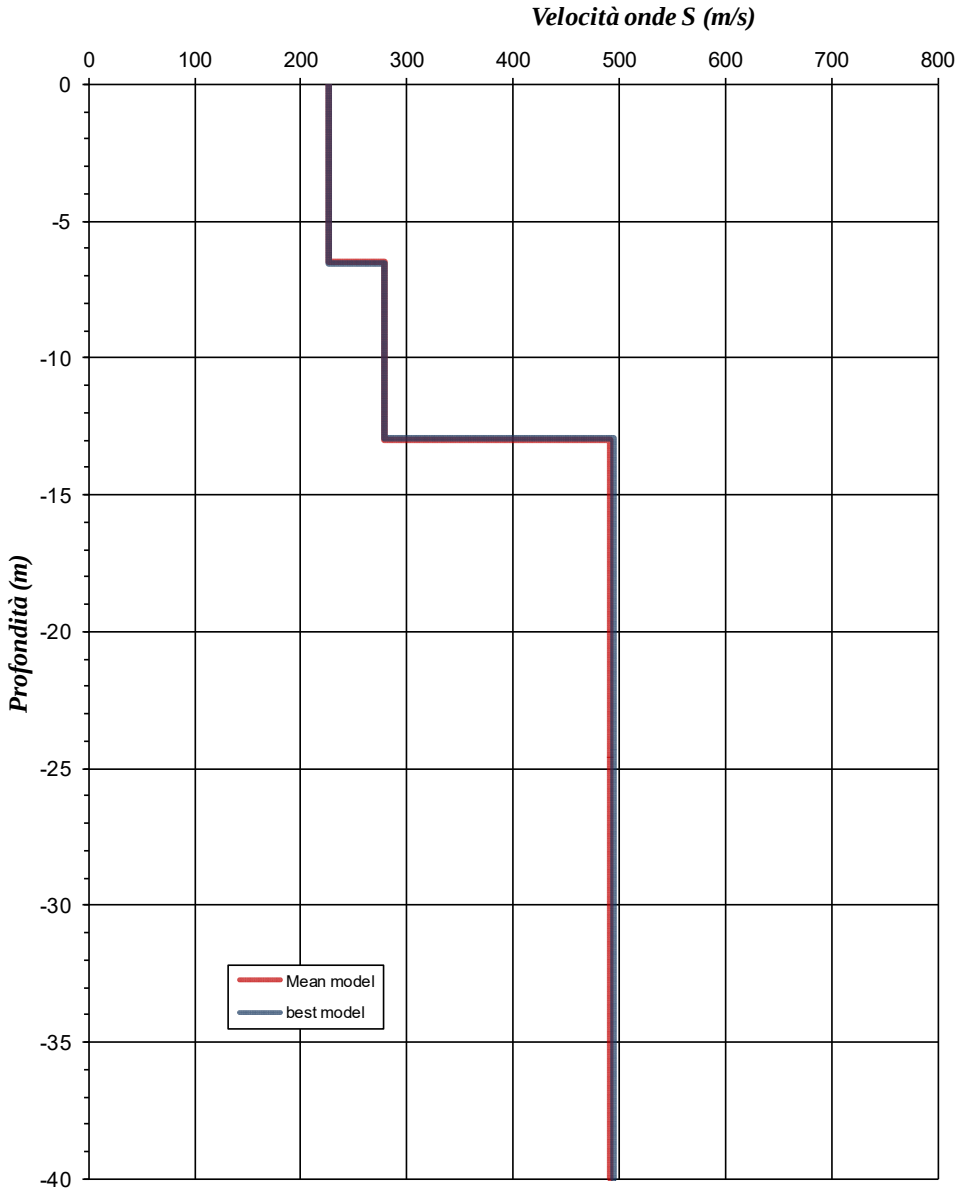


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 2					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	6,5	226	0	6,5	226
6,5	13,0	279	6,5	13,0	279
13,0	40	494	13,0	40	492
Vseq = 347 m/s			Vseq = 346 m/s		

MASW Montevarchi 3

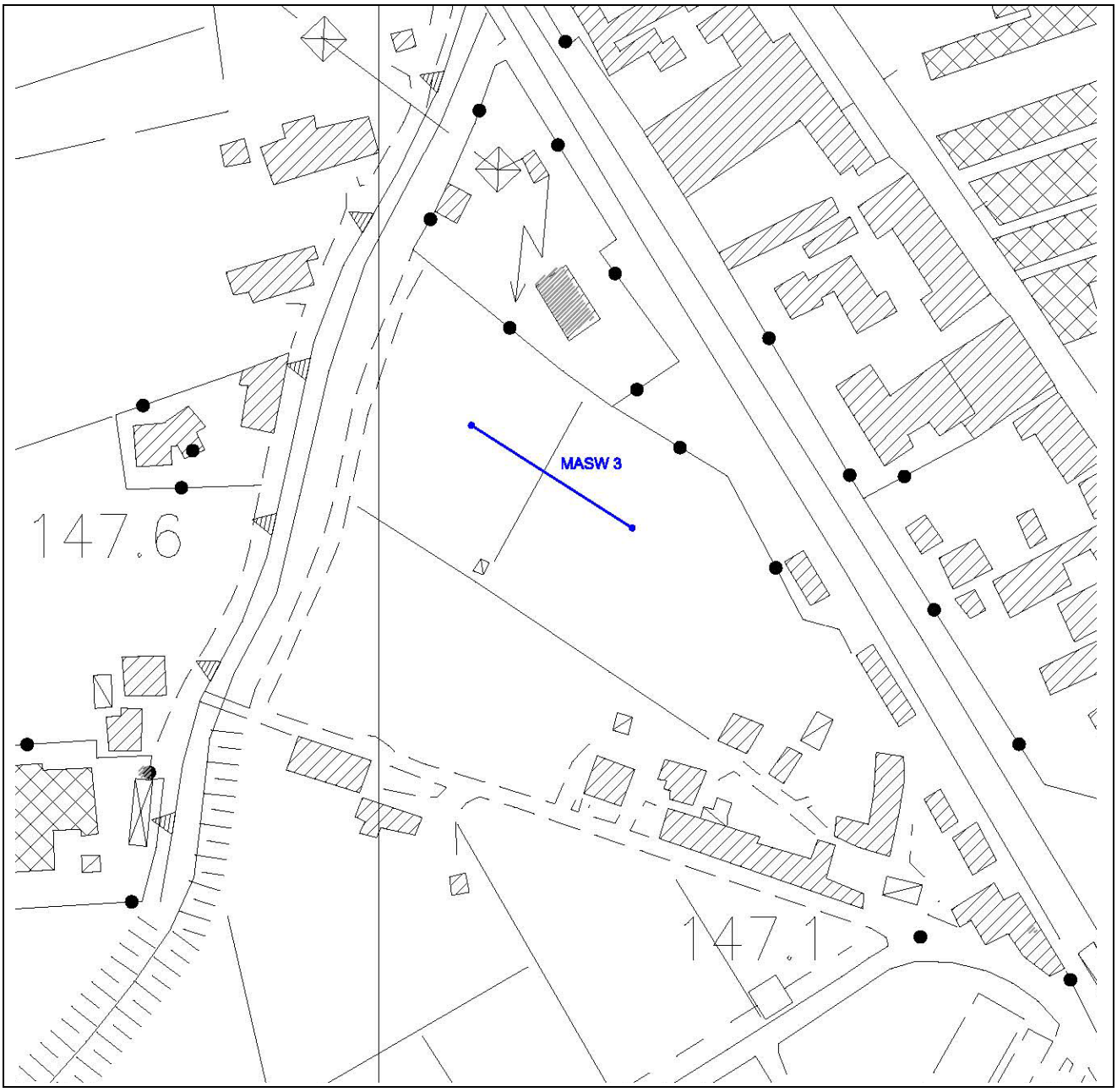


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

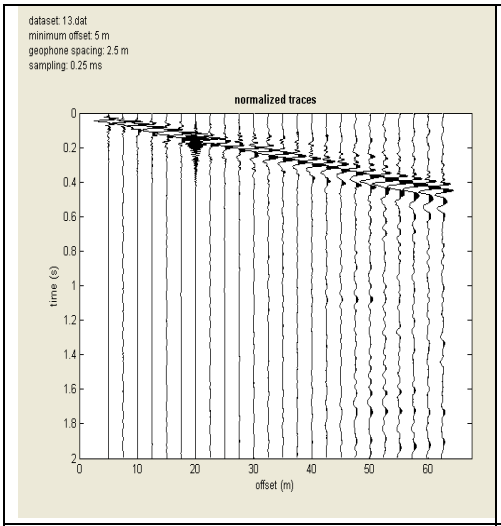


Figura: Sismogramma

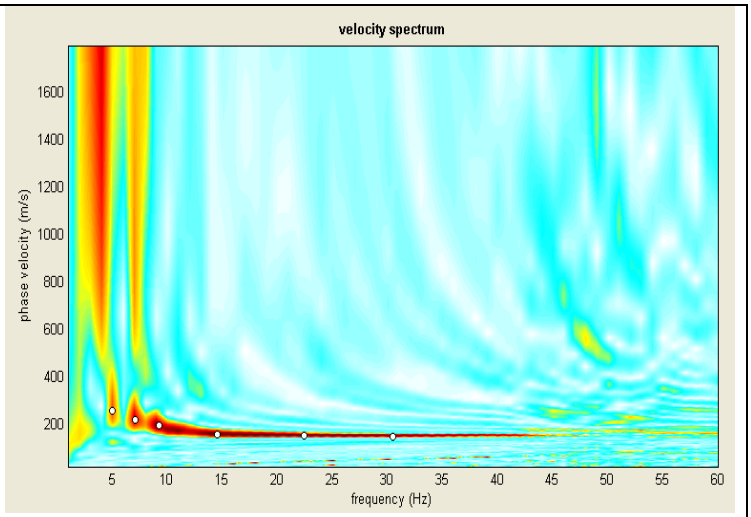
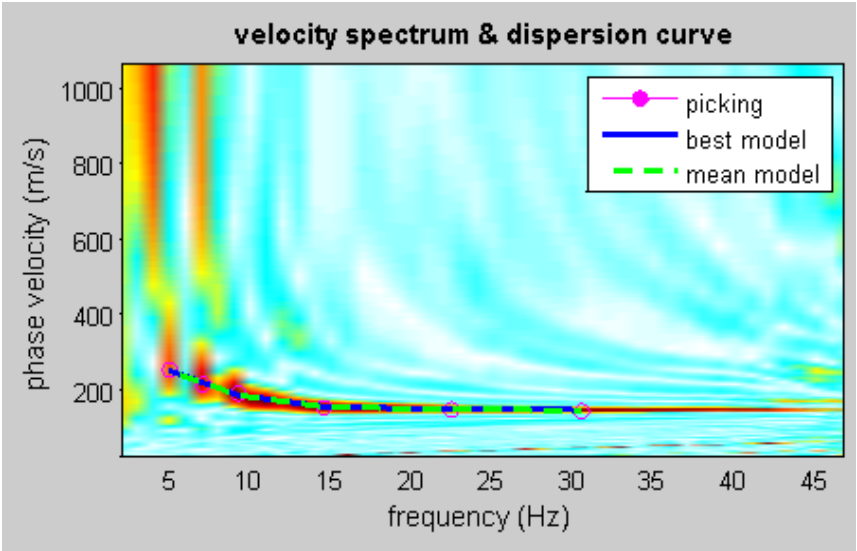


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 3

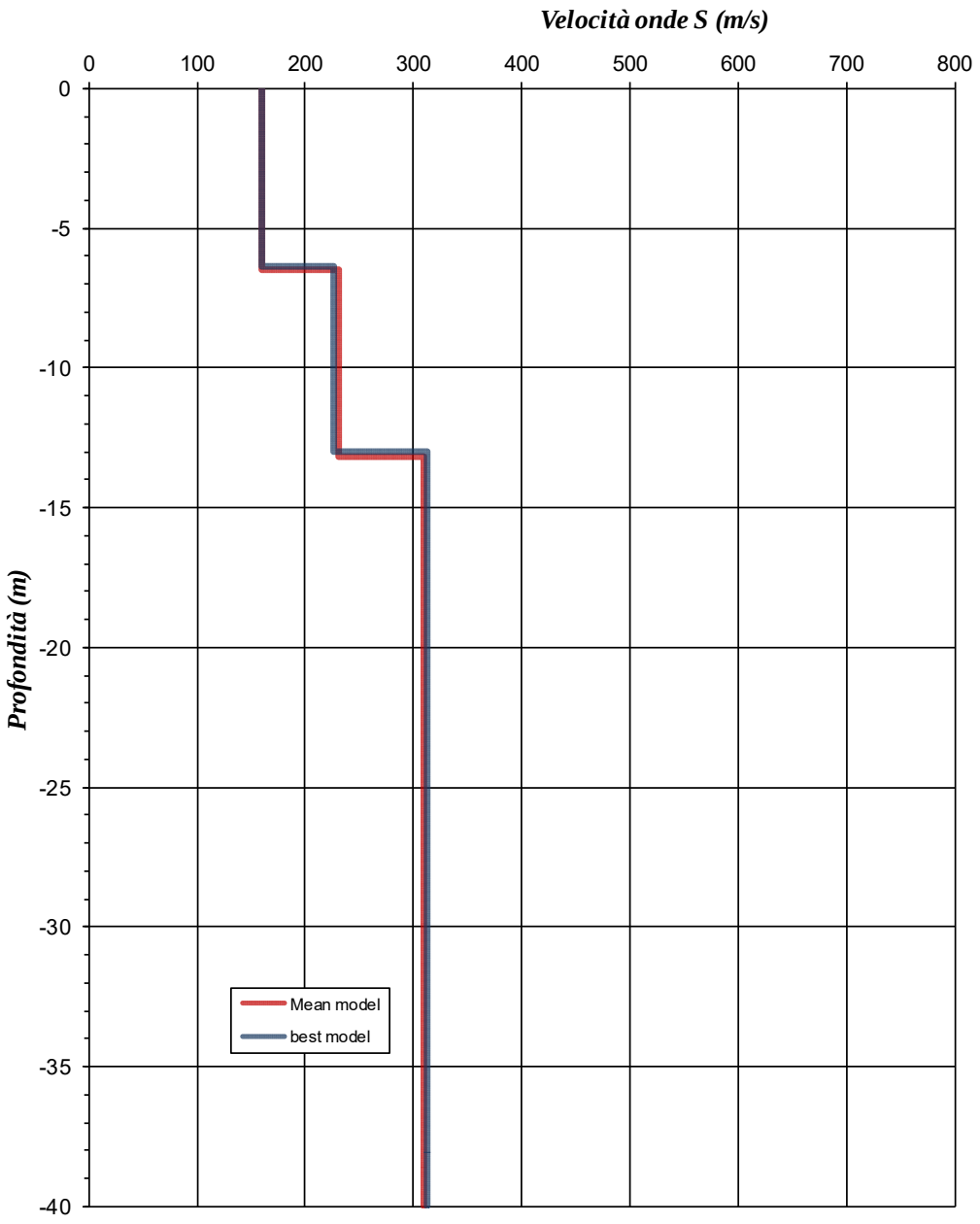


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 3					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	6,3	160	0	6,5	160
6,3	13,0	226	6,5	13,2	231
13,0	40	312	13,2	40	309
Vseq = 243 m/s			Vseq = 242 m/s		

MASW Montevarchi 4

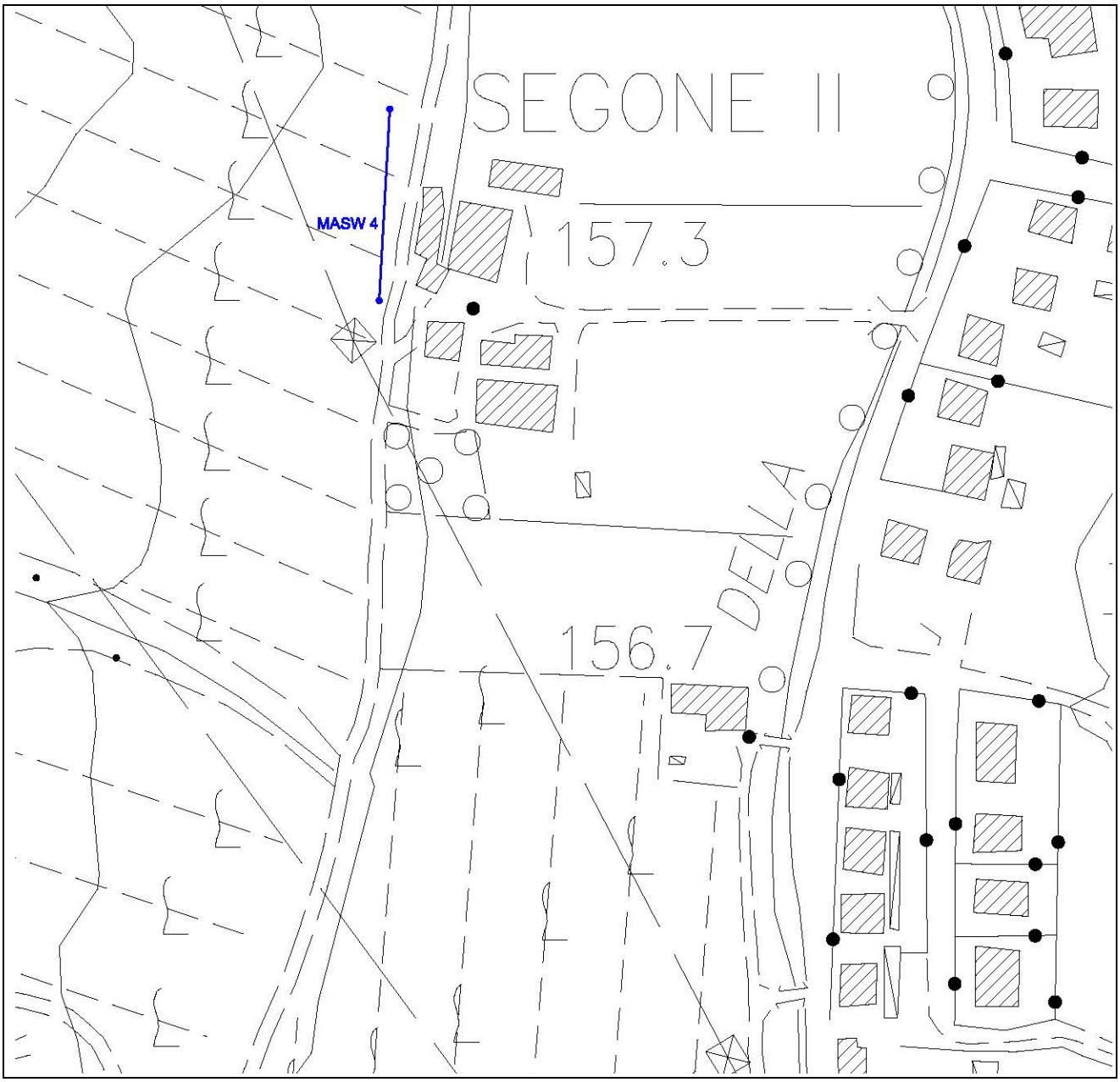


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

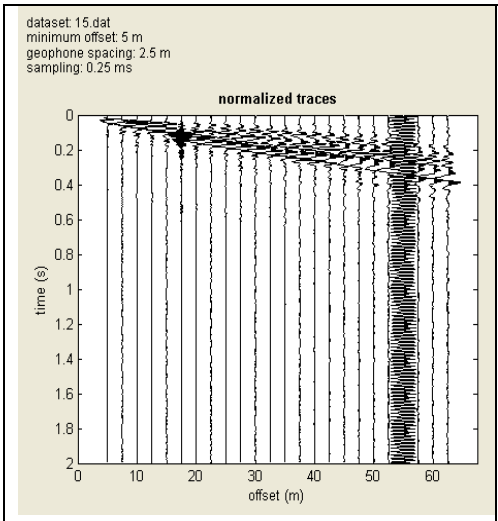


Figura: Sismogramma

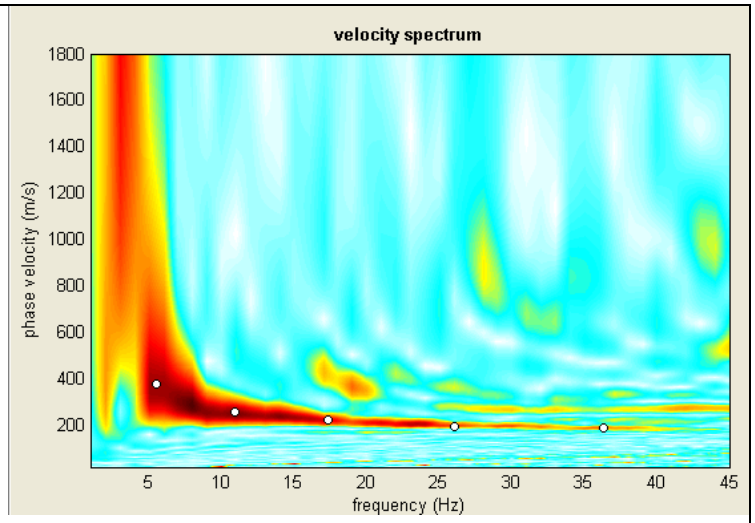
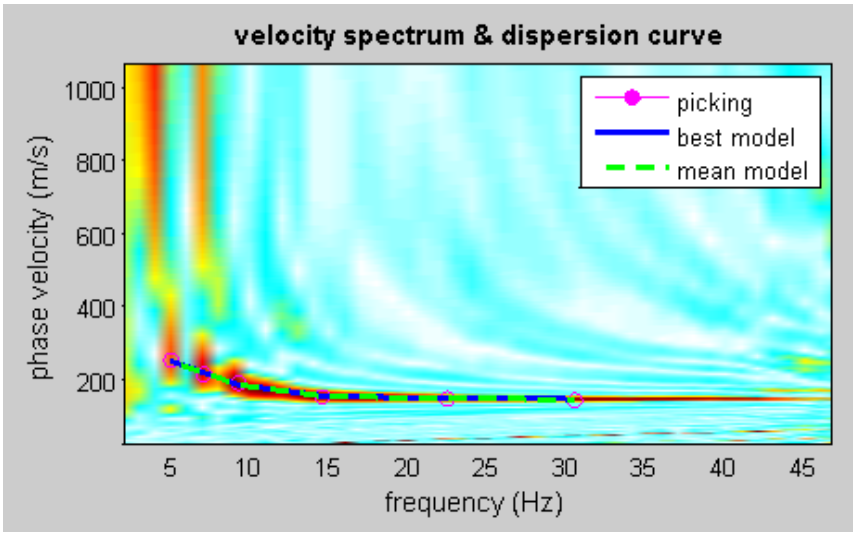


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 4

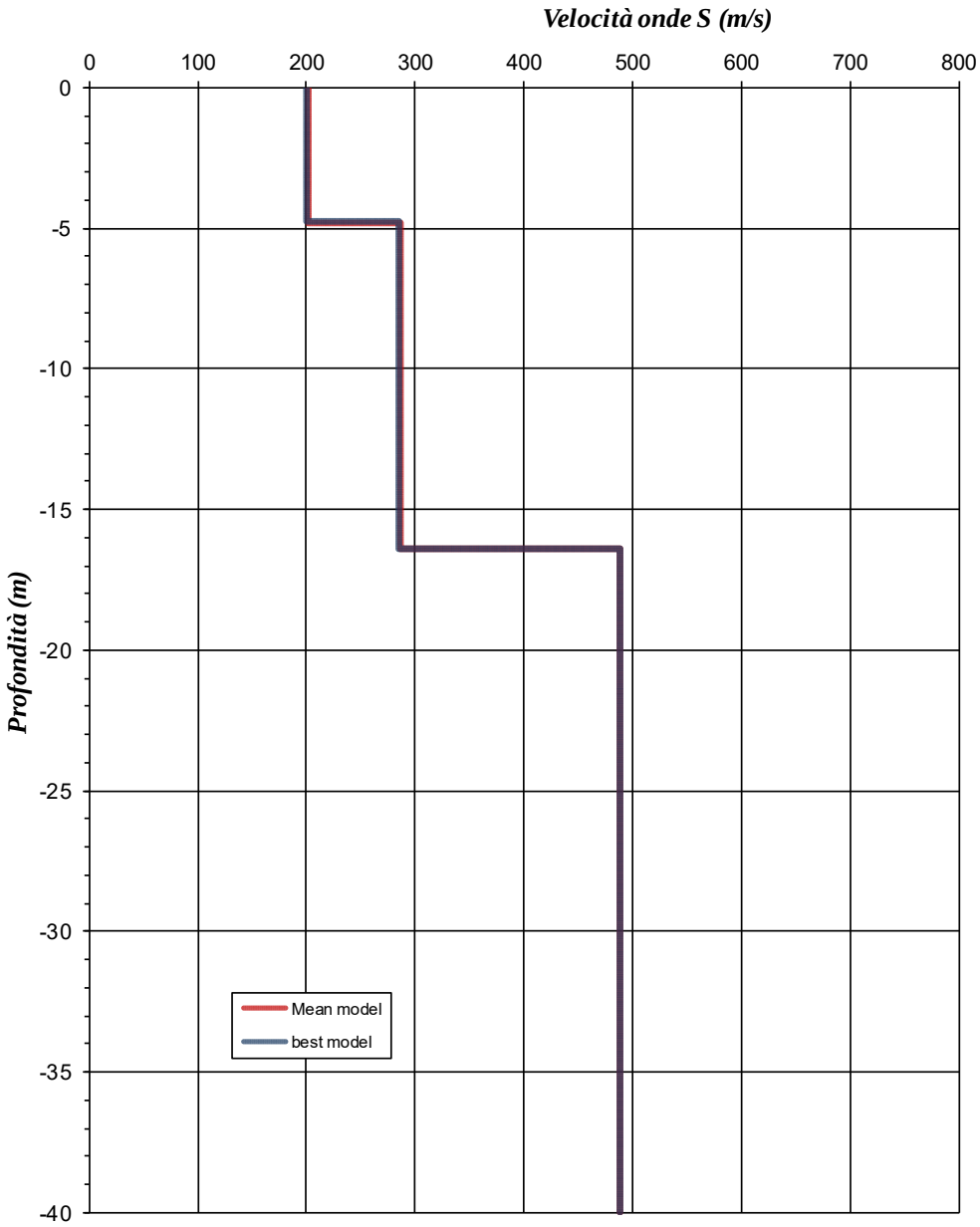


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 4					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	4,7	200	0	4,8	201
4,7	16,4	286	4,8	16,4	286
16,4	40	488	16,4	40	489
Vseq = 325 m/s			Vseq = 325 m/s		

MASW Montevarchi 5

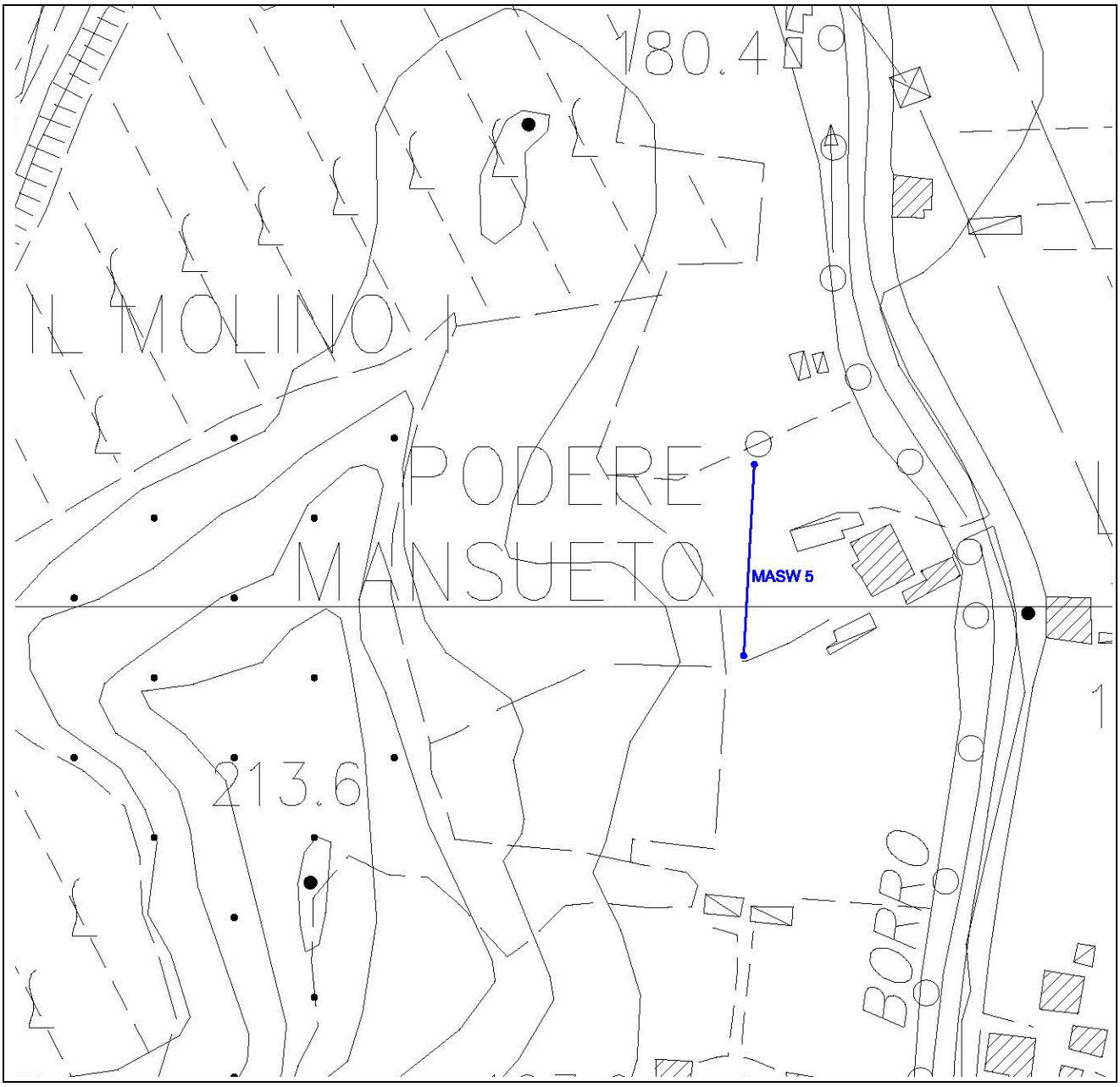


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

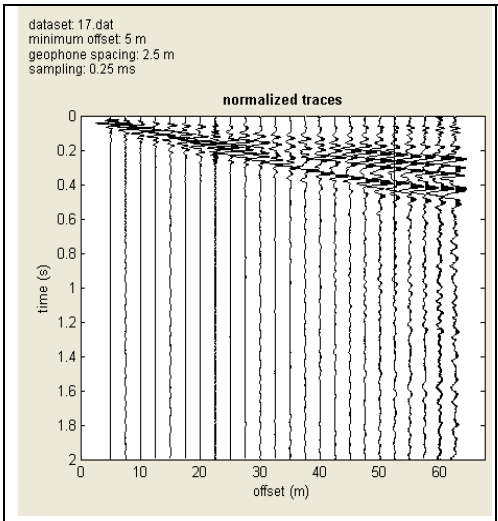


Figura: Sismogramma

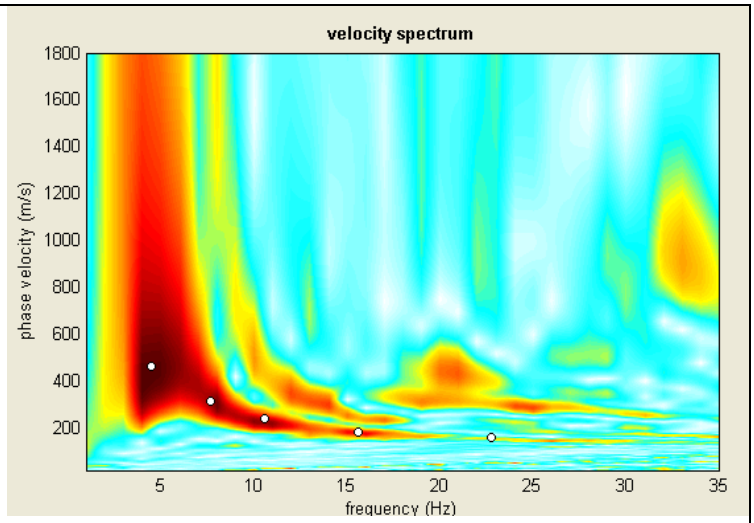
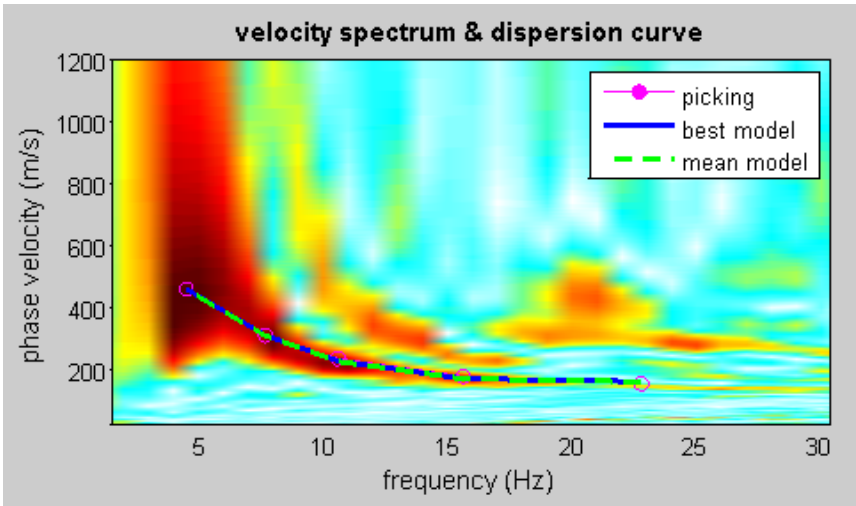


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 5

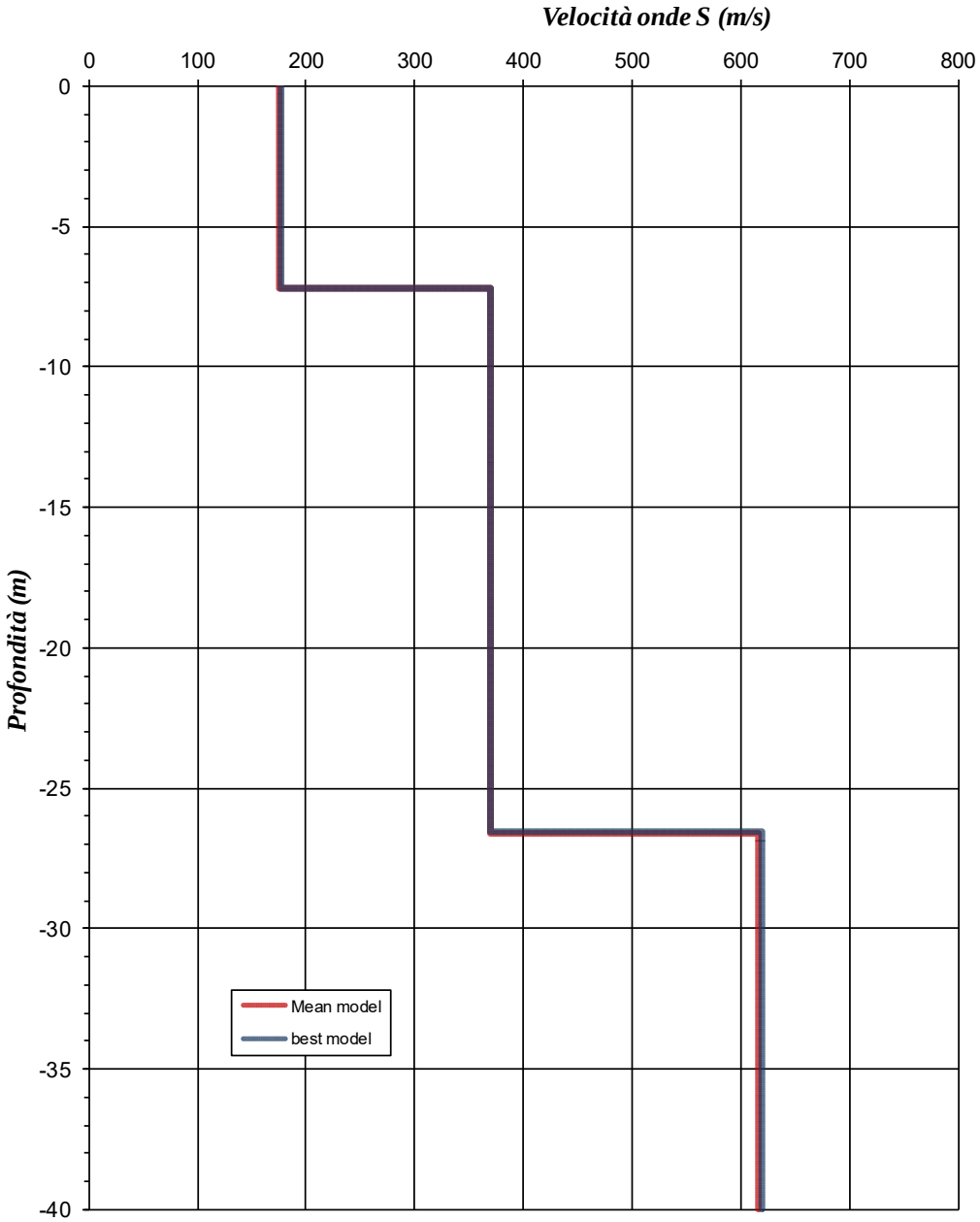


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 5					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	7,2	176	0	7,2	176
7,2	26,6	370	7,2	26,6	370
26,6	40	619	26,6	40	616
Vseq = 304 m/s			Vseq = 304 m/s		

MASW Montevarchi 6

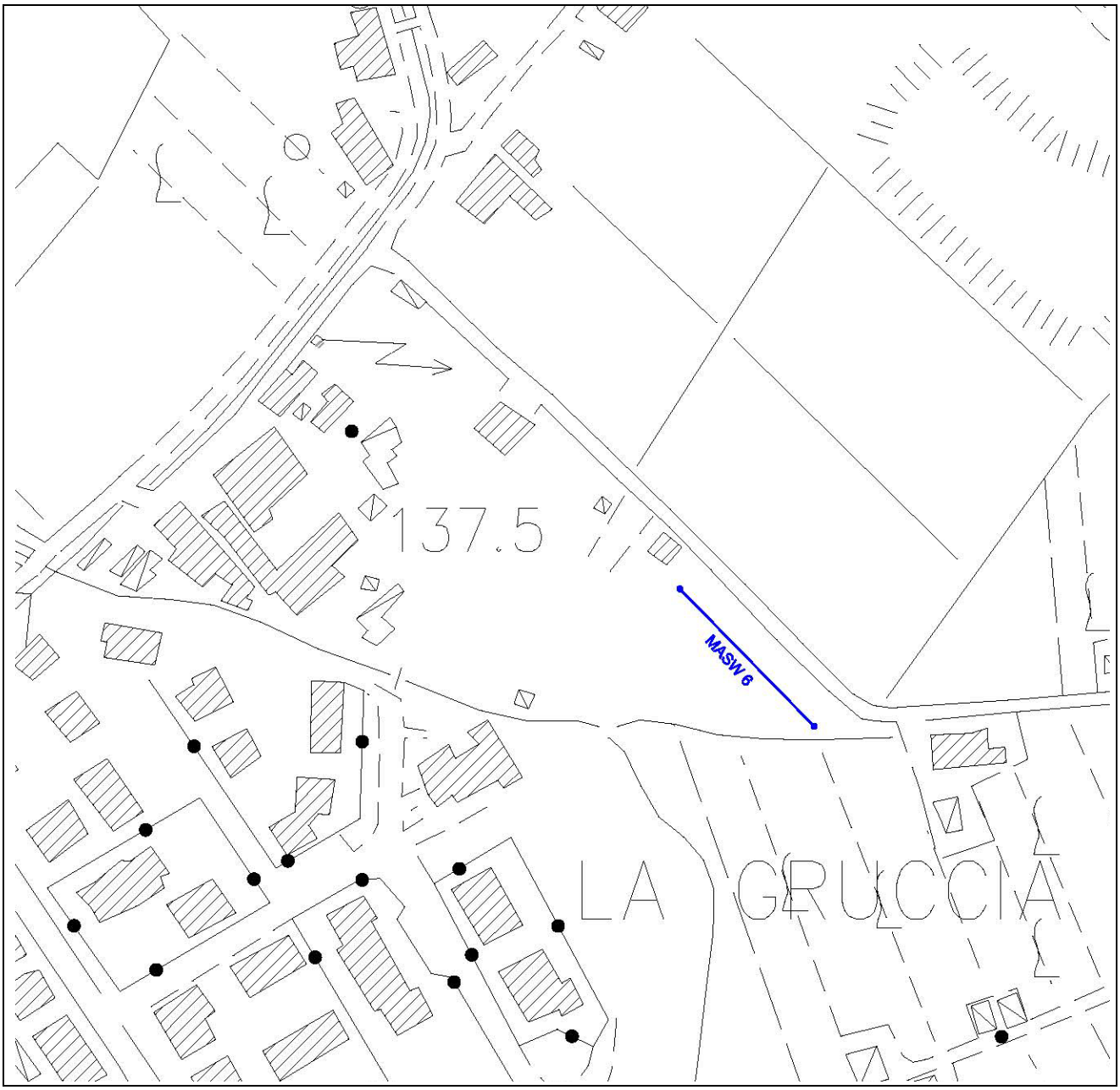


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

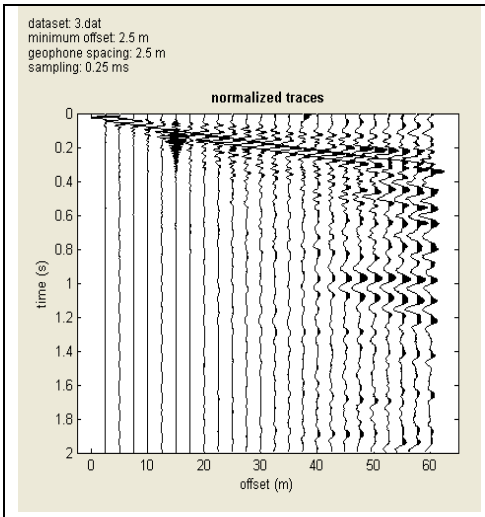


Figura: Sismogramma

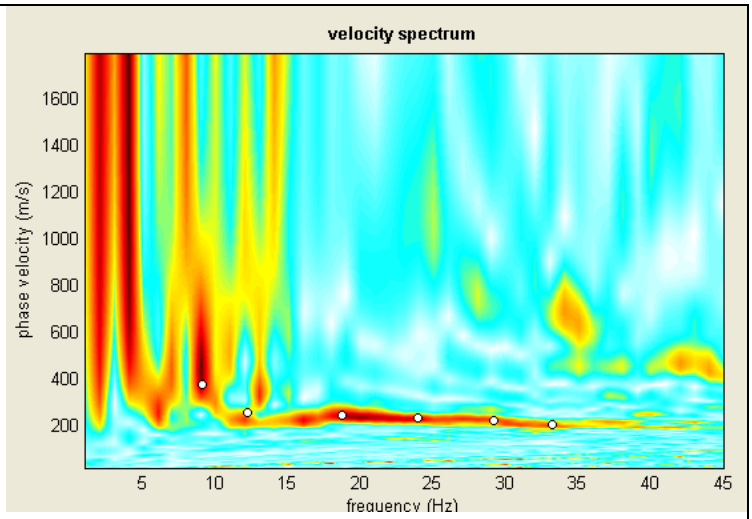
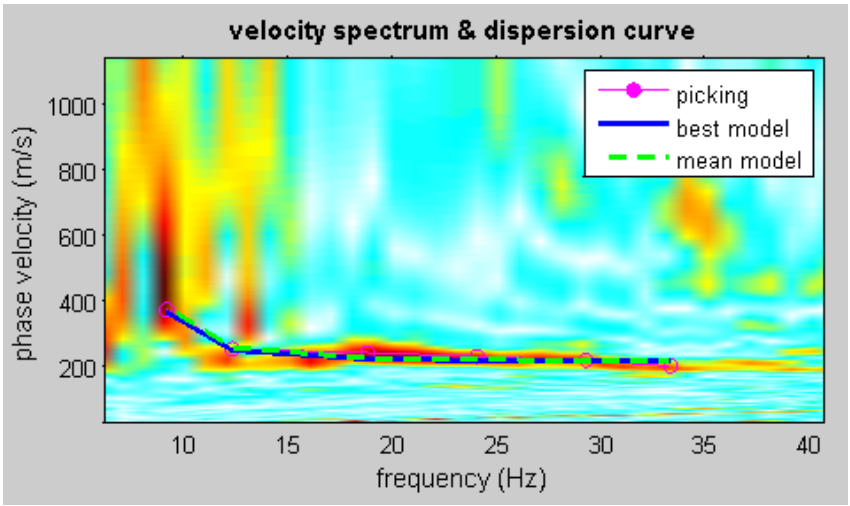


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 6

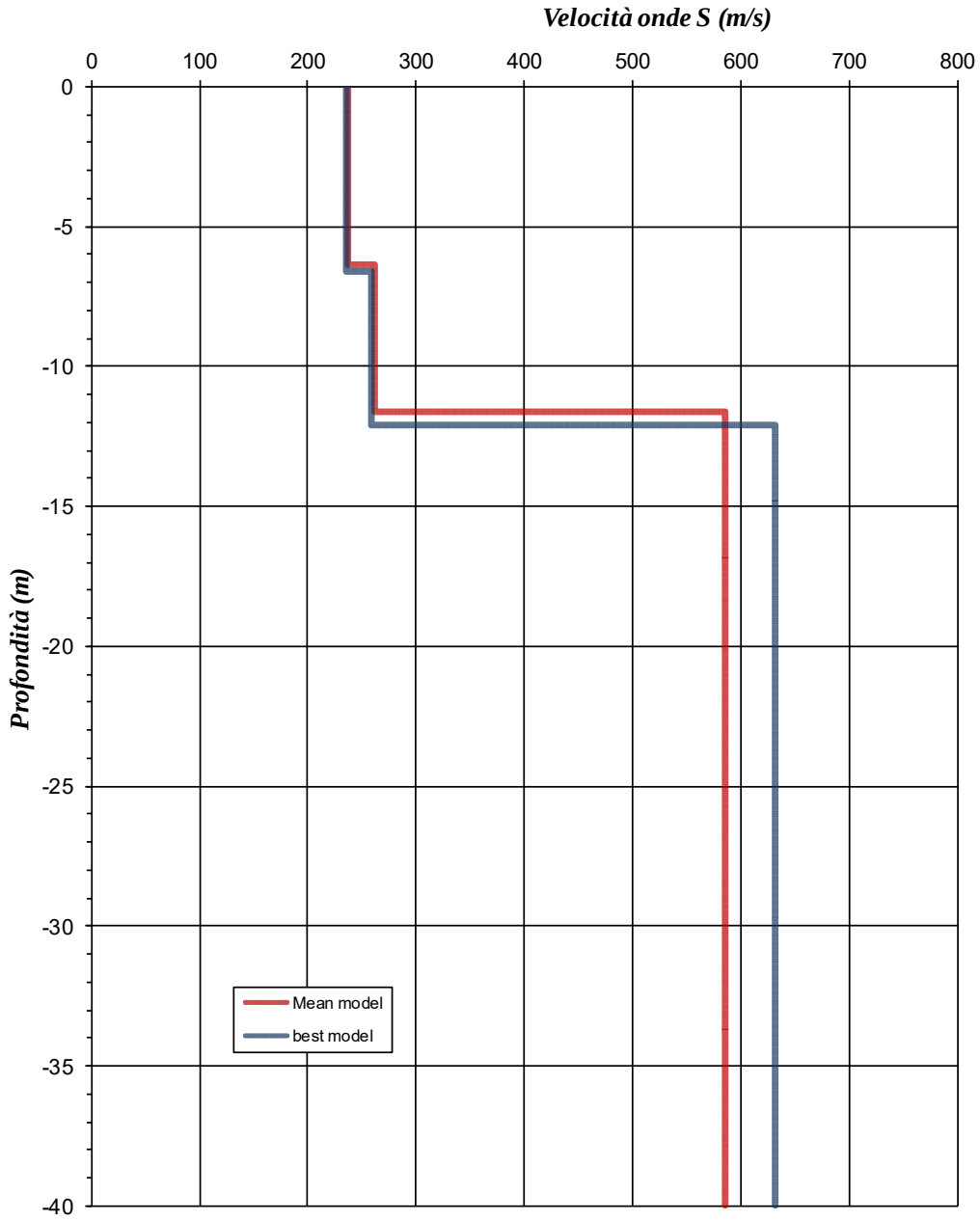


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 6					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	6,6	235	0	6,4	237
6,6	12,1	259	6,4	11,6	261
12,1	40	632	11,6	40	585
Vseq = 386 m/s			Vseq = 383 m/s		

MASW Montevarchi 7

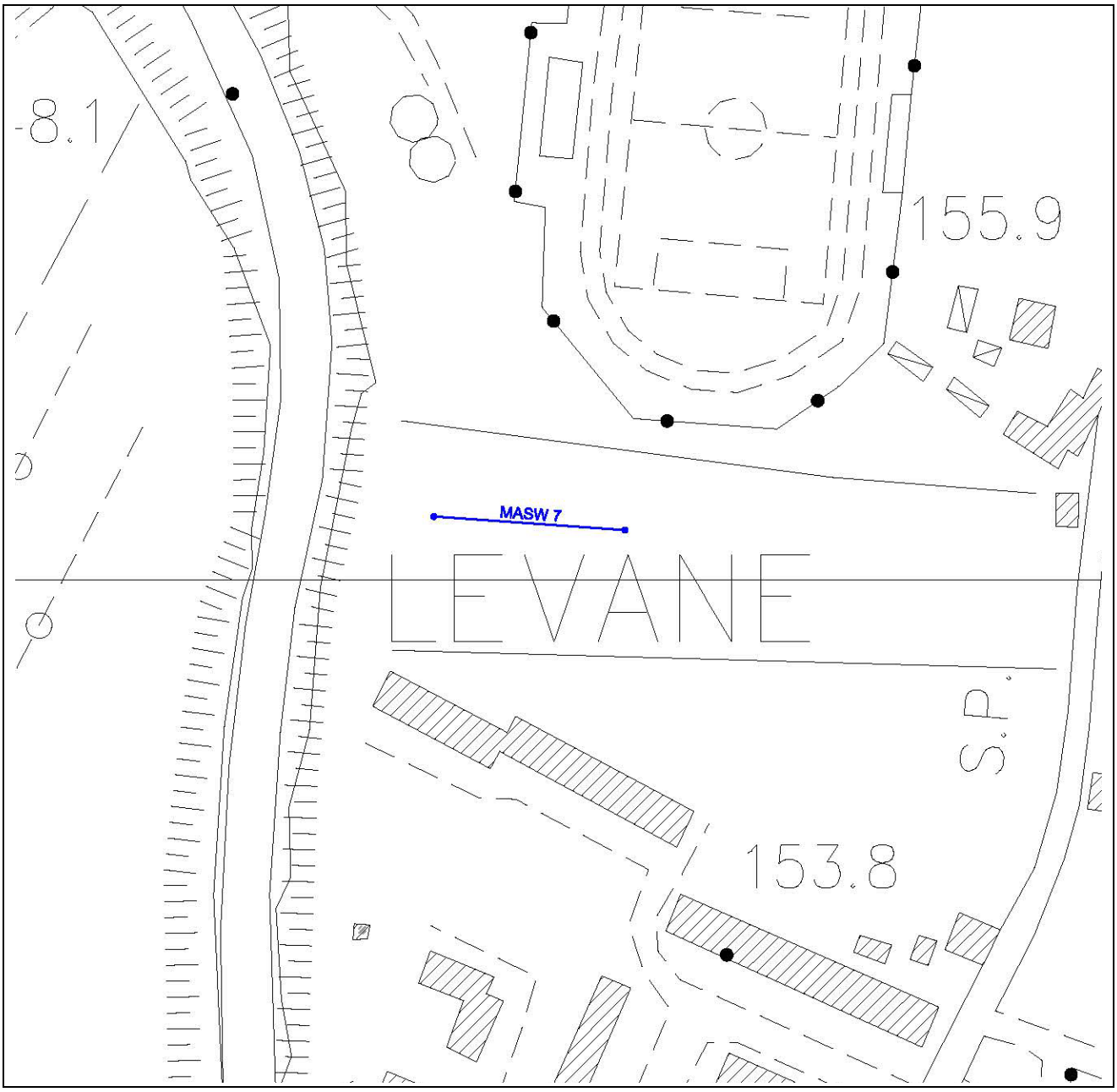


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

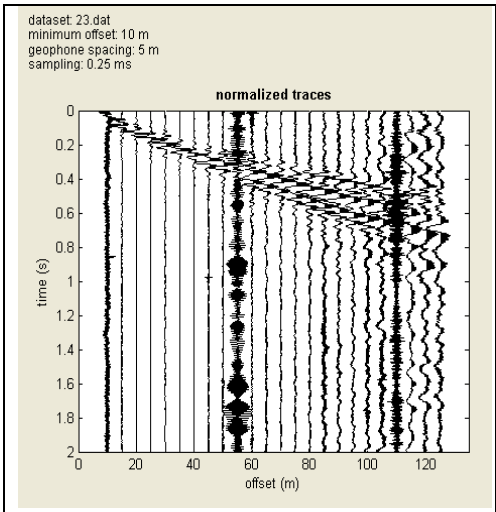


Figura: Sismogramma

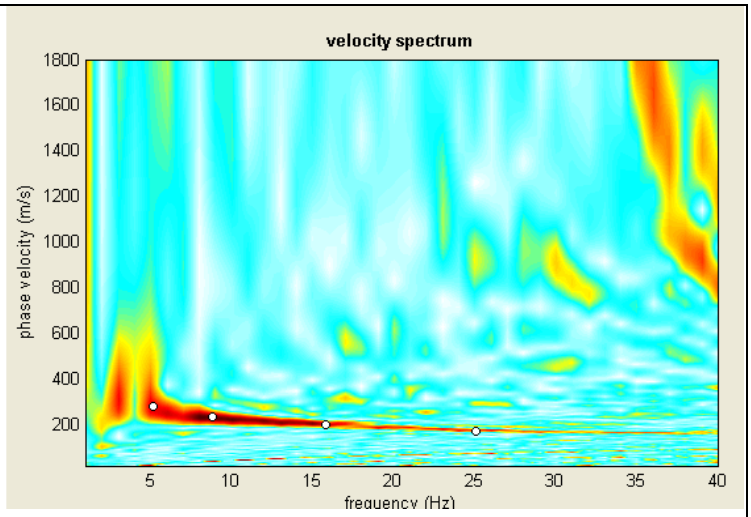
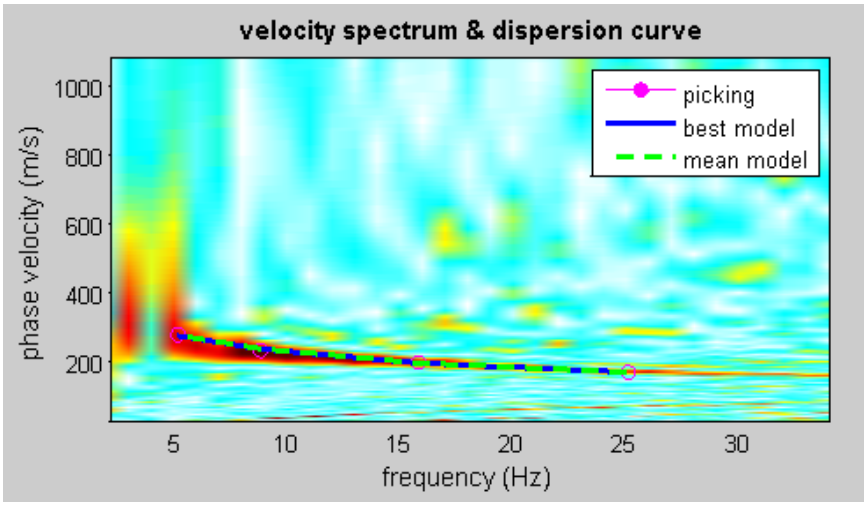


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 7

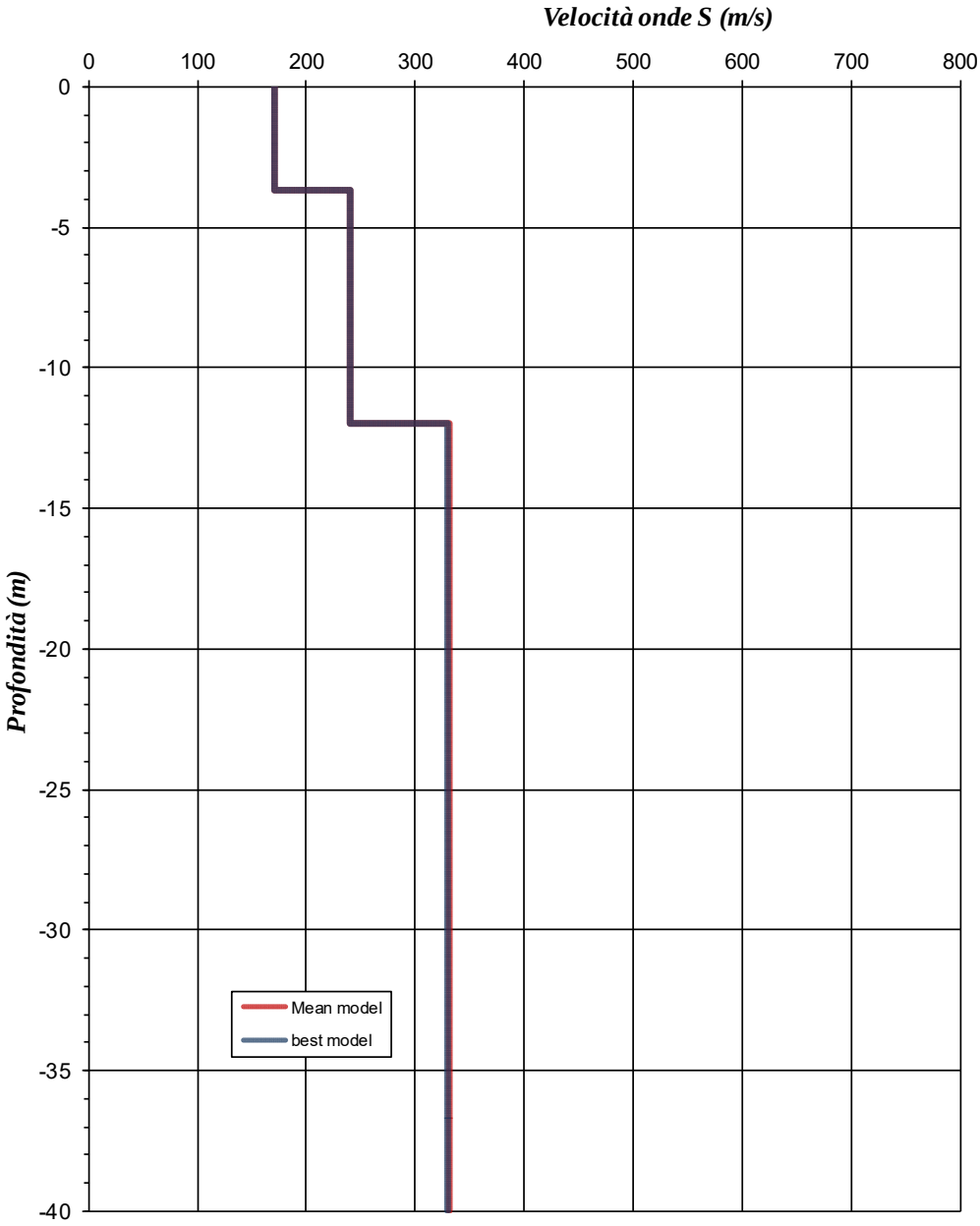


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 7					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	3,7	171	0	3,7	171
3,7	12,0	240	3,7	12,0	240
12,0	40	329	12,0	40	331
Vseq = 271 m/s			Vseq = 271 m/s		

MASW Montevarchi 8

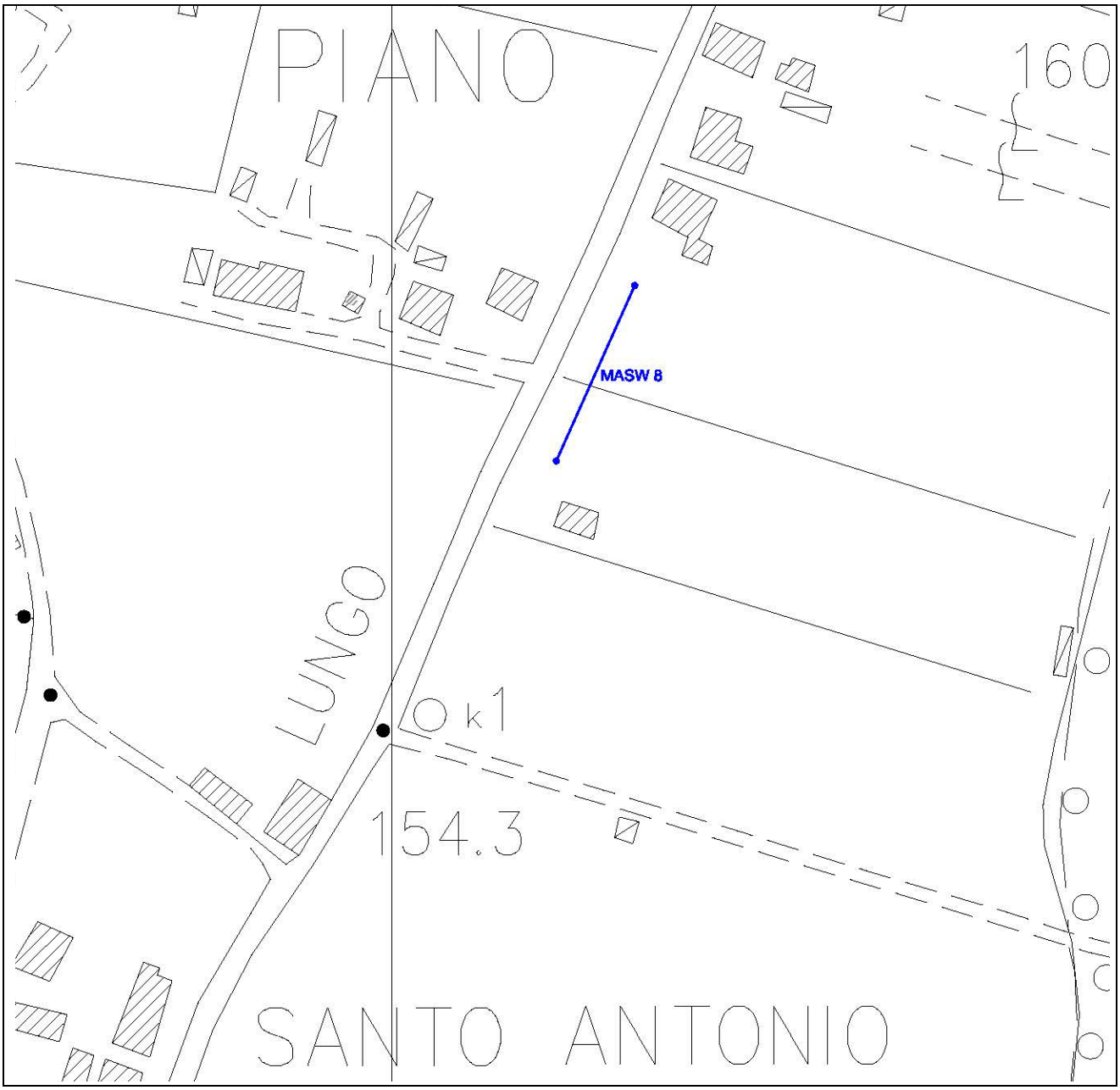


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

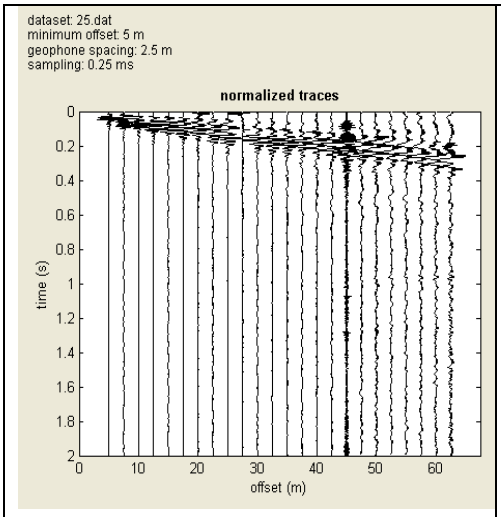


Figura: Sismogramma

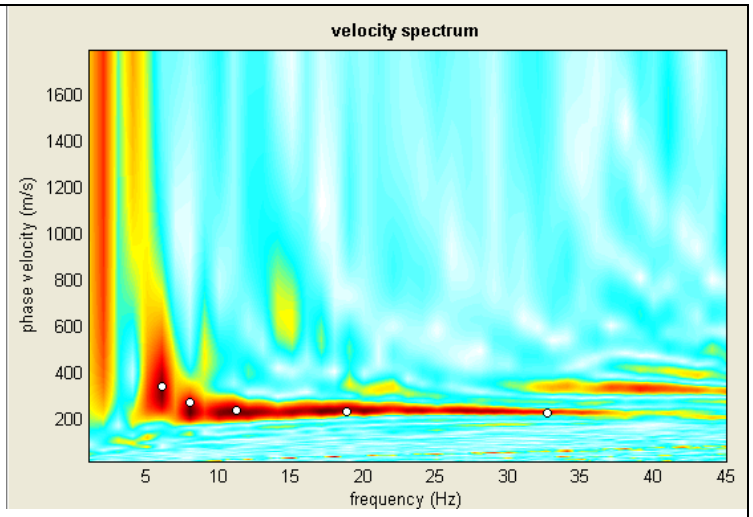
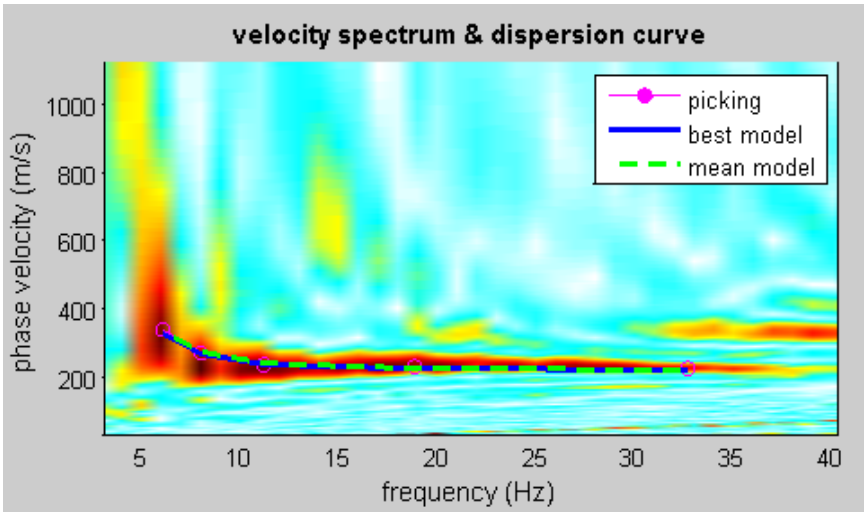


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 8

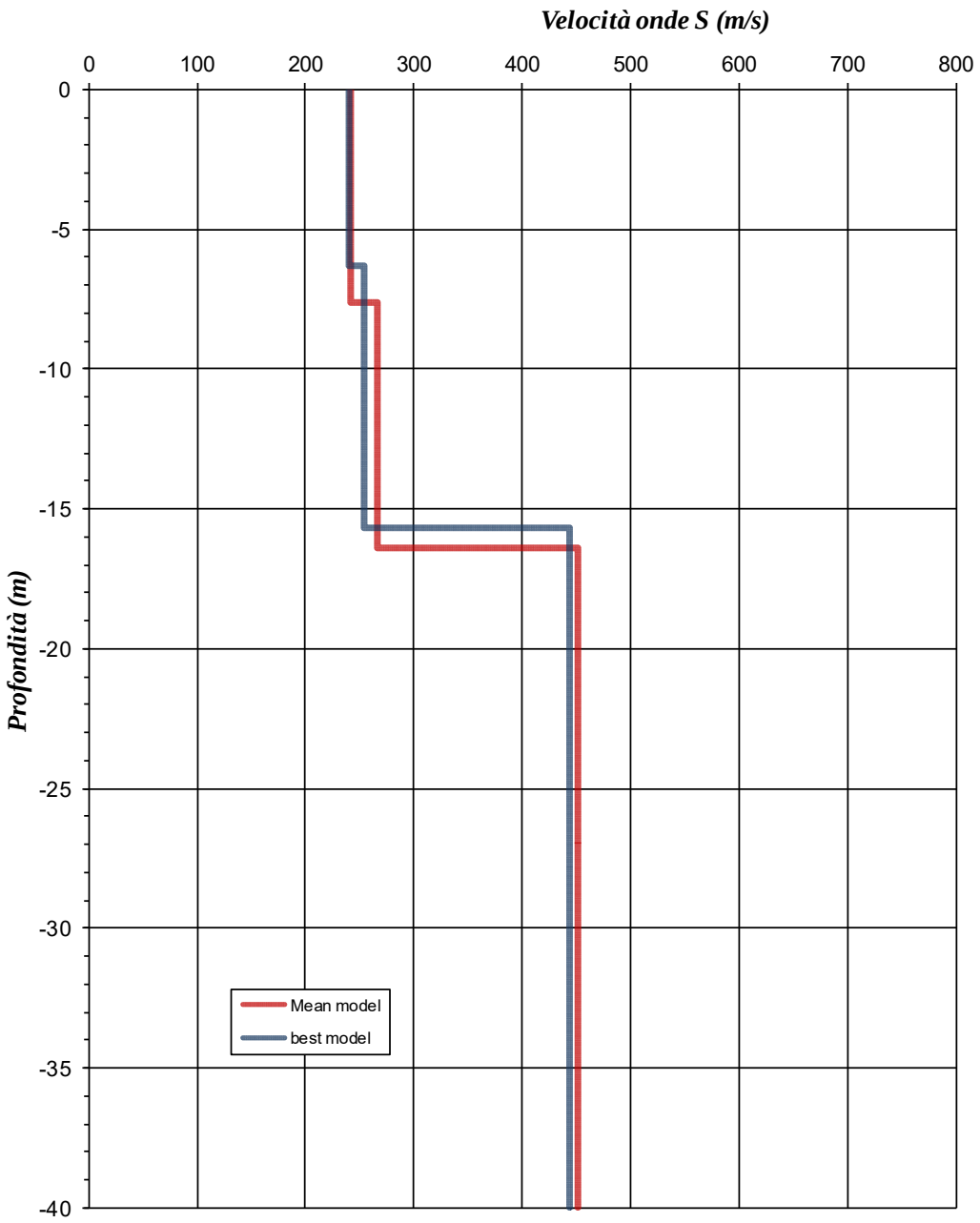


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 8					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	6,3	240	0	7,6	241
6,3	15,7	253	7,6	16,4	267
15,7	40	444	16,4	40	452
Vseq = 315 m/s			Vseq = 317 m/s		

MASW Montevarchi 9

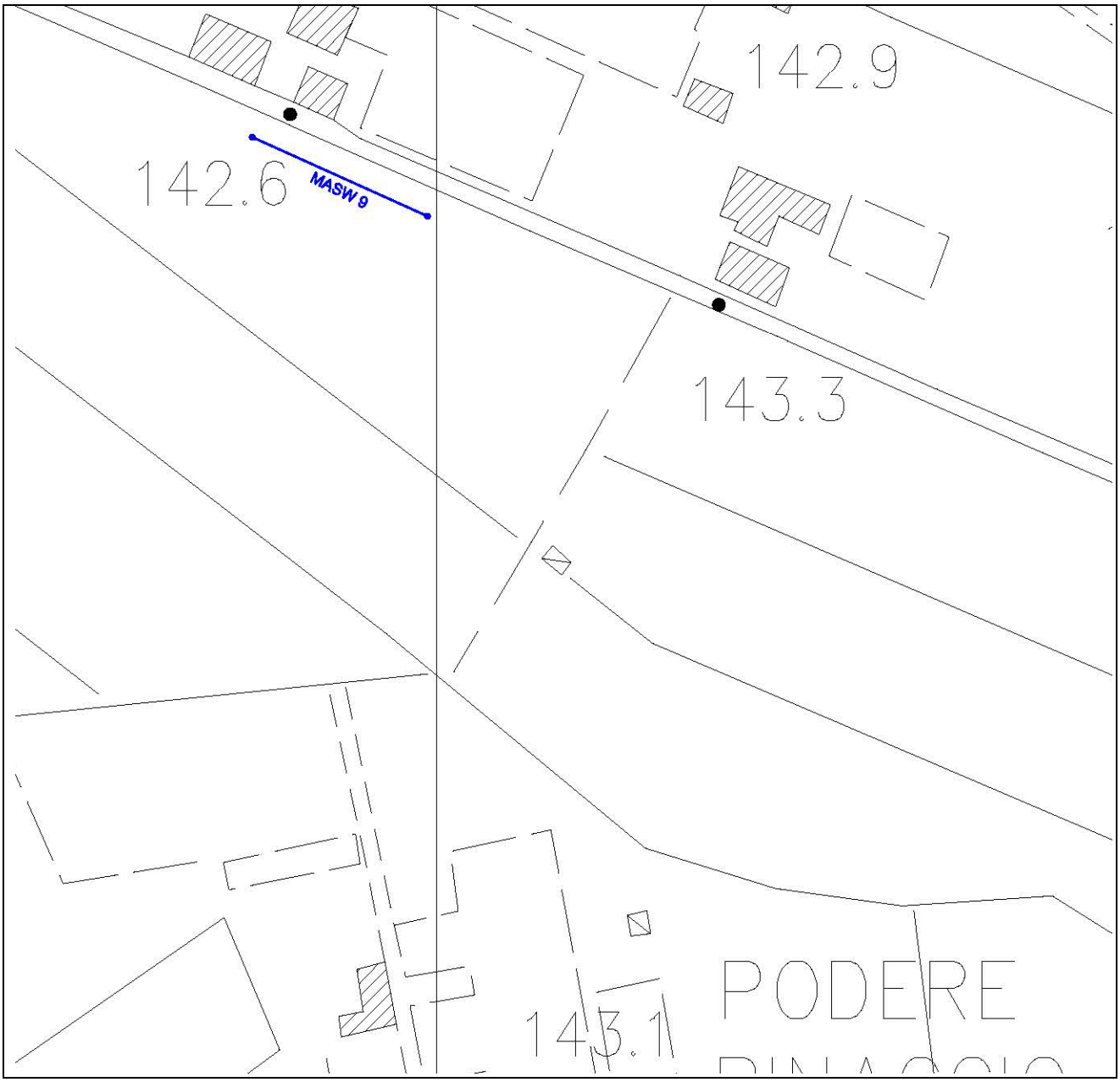


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

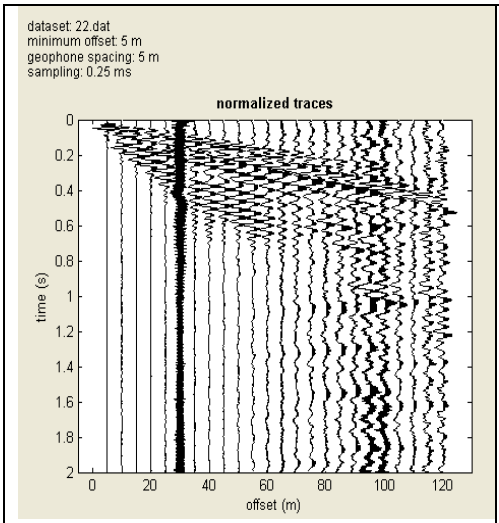


Figura: Sismogramma

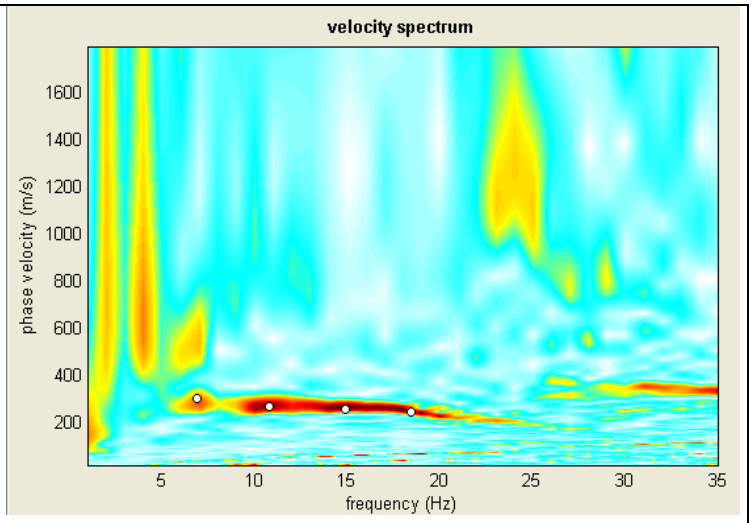
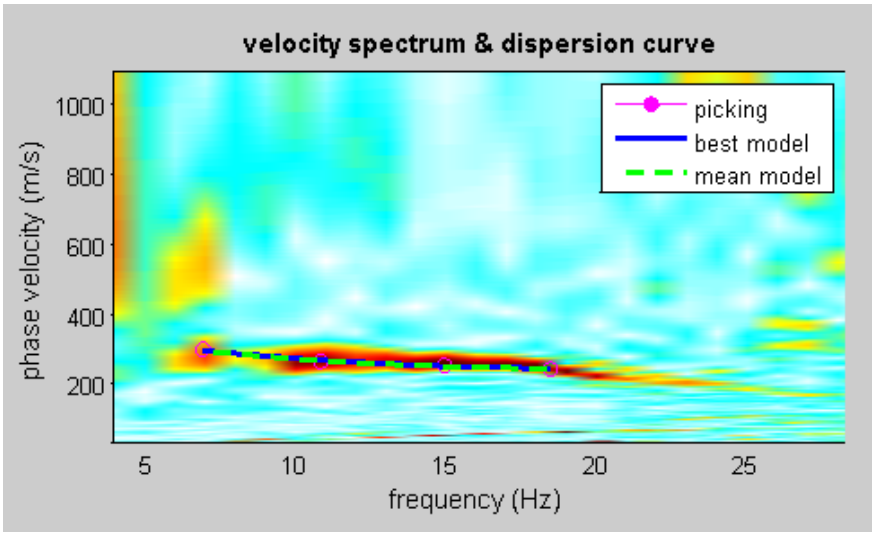


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi9

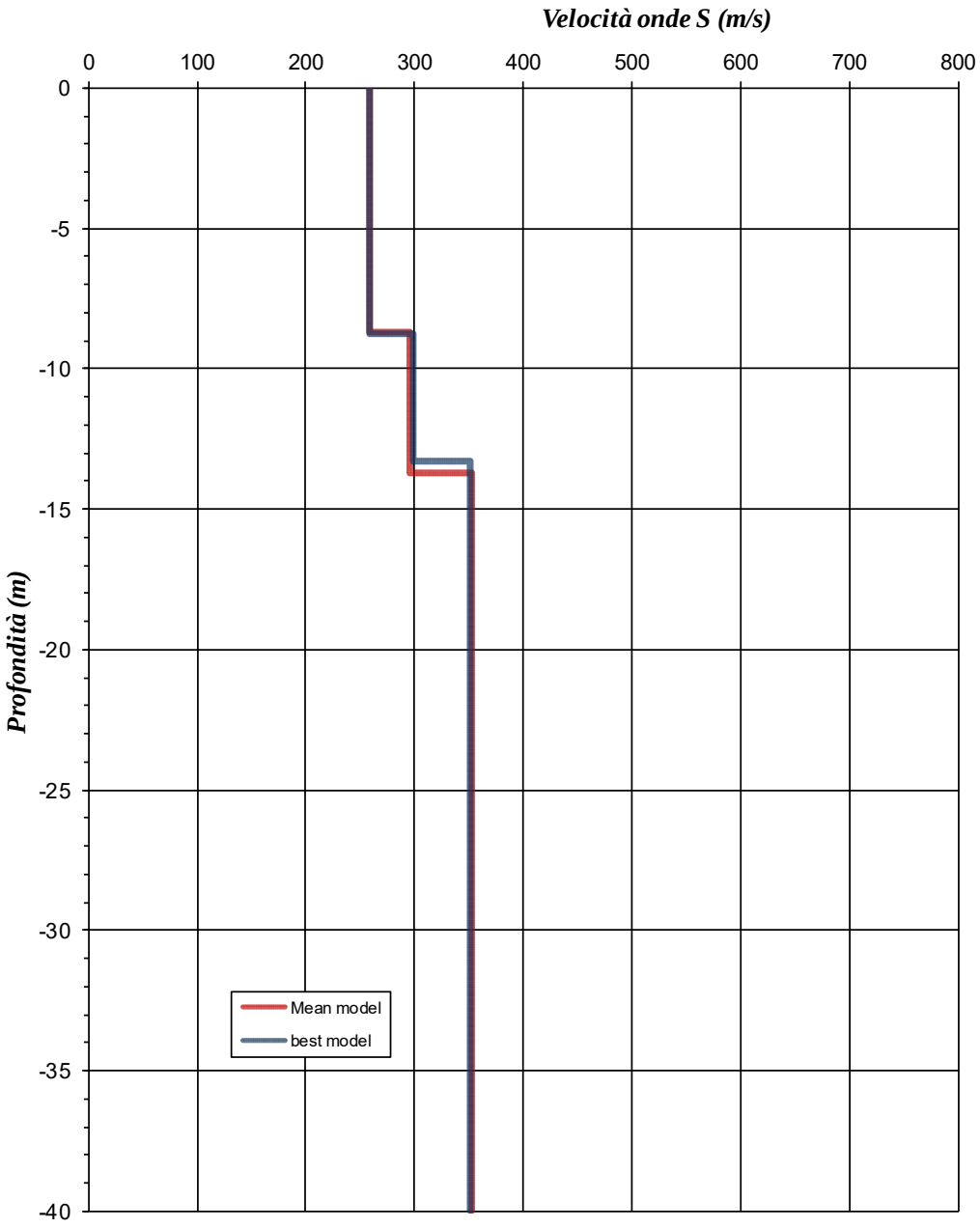


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 9					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	8,8	259	0	8,7	259
8,8	13,3	299	8,7	13,7	296
13,3	40	351	13,7	40	352
Vseq = 311 m/s			Vseq = 310 m/s		

MASW Montevarchi 10

Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

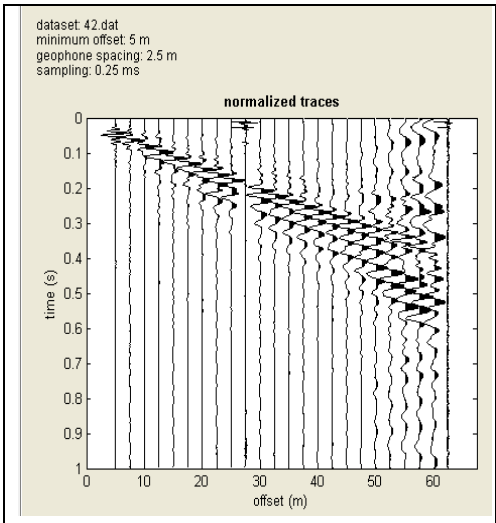


Figura: Sismogramma

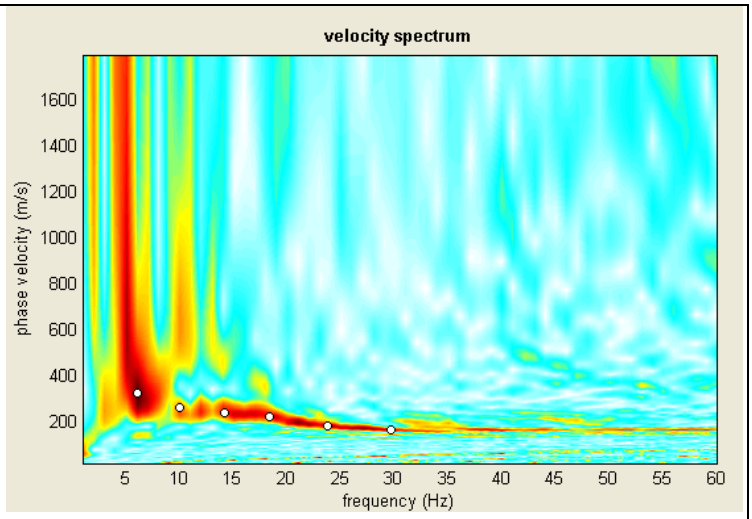
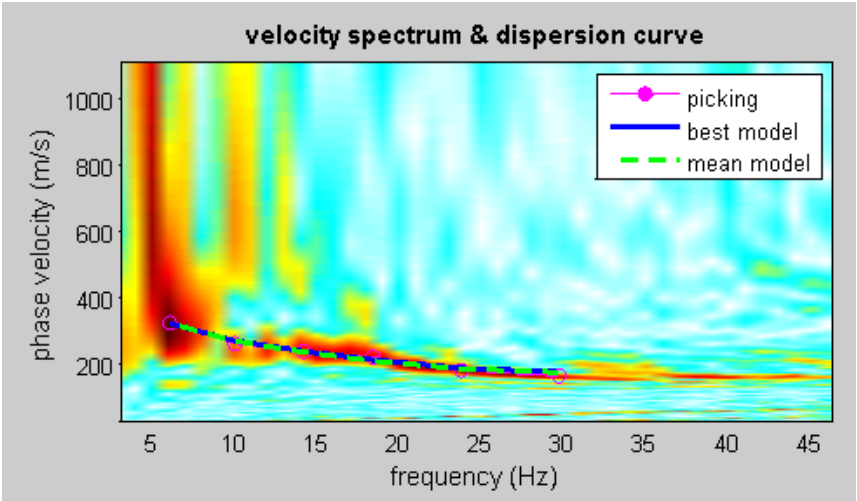


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 10

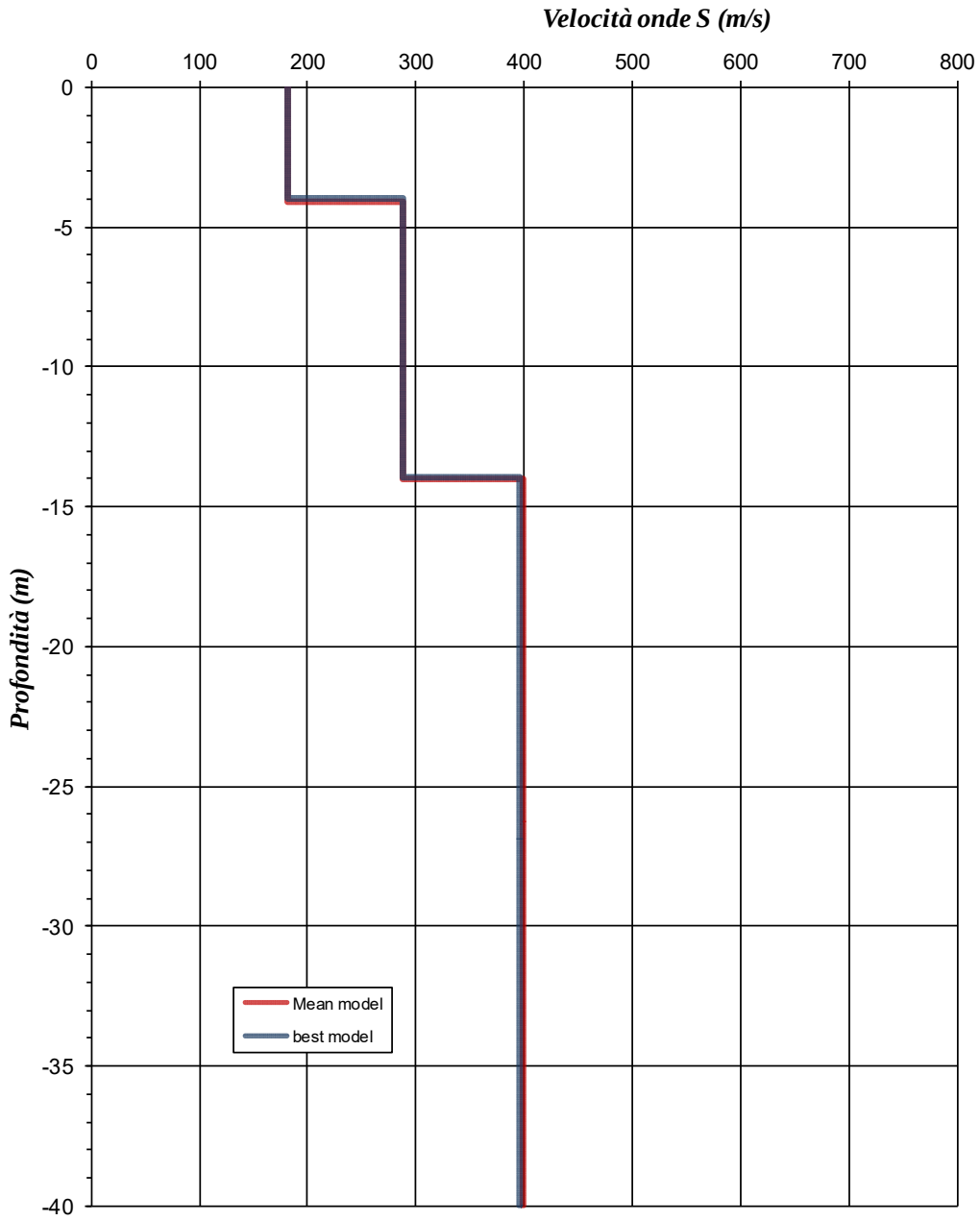


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 10					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	4,0	182	0	4,1	182
4,0	14,0	288	4,1	14,0	288
14,0	40	396	14,0	40	399
Vseq = 310 m/s			Vseq = 309 m/s		

MASW Montevarchi 11

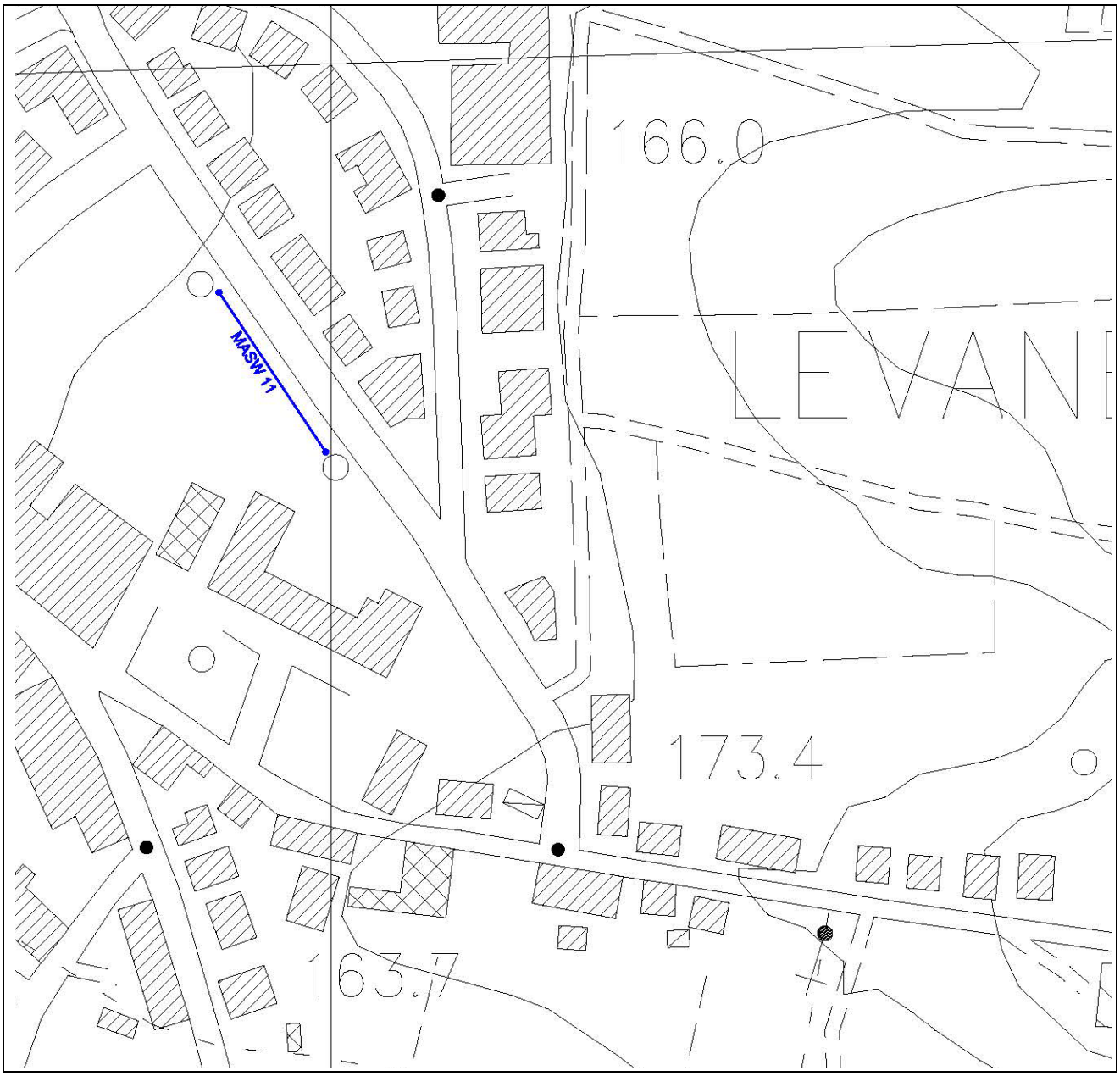


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

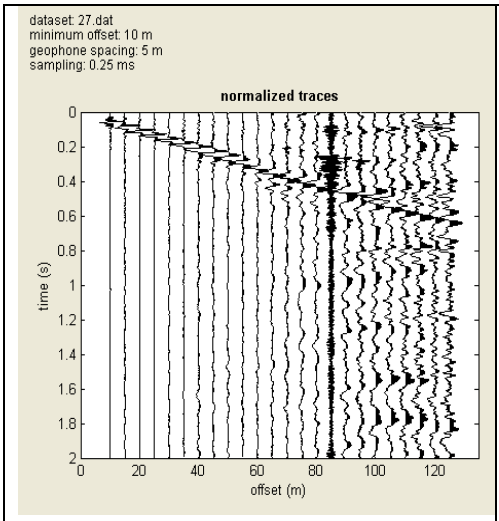


Figura: Sismogramma

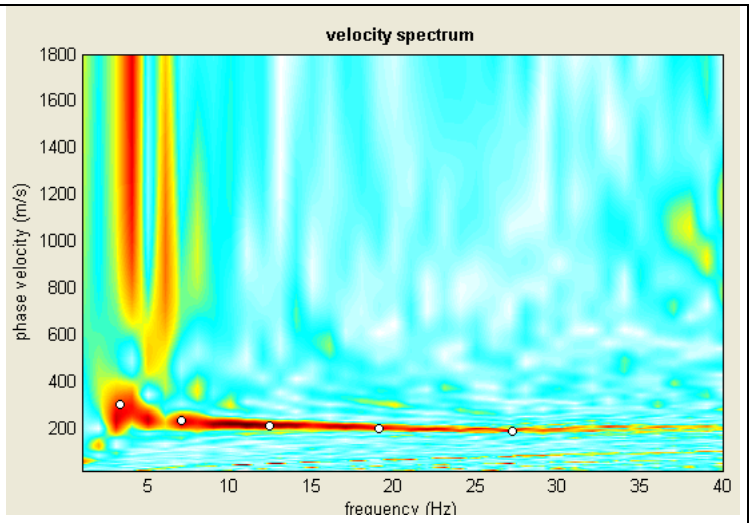
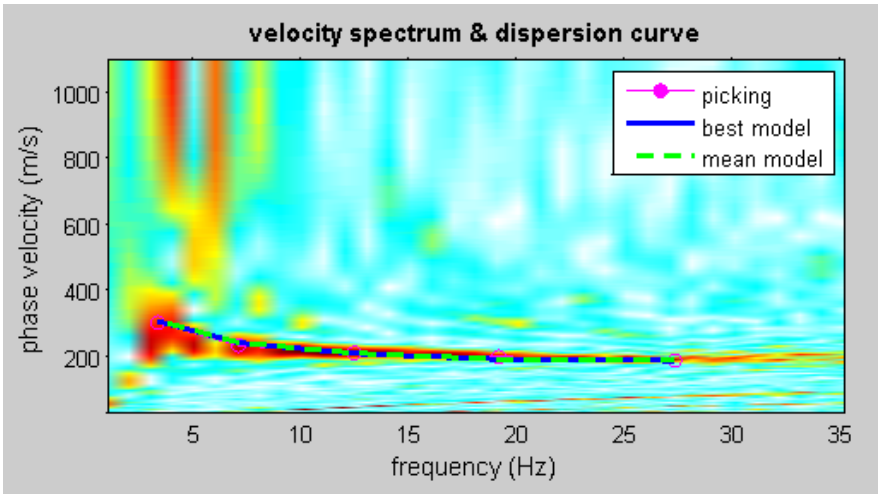


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 11

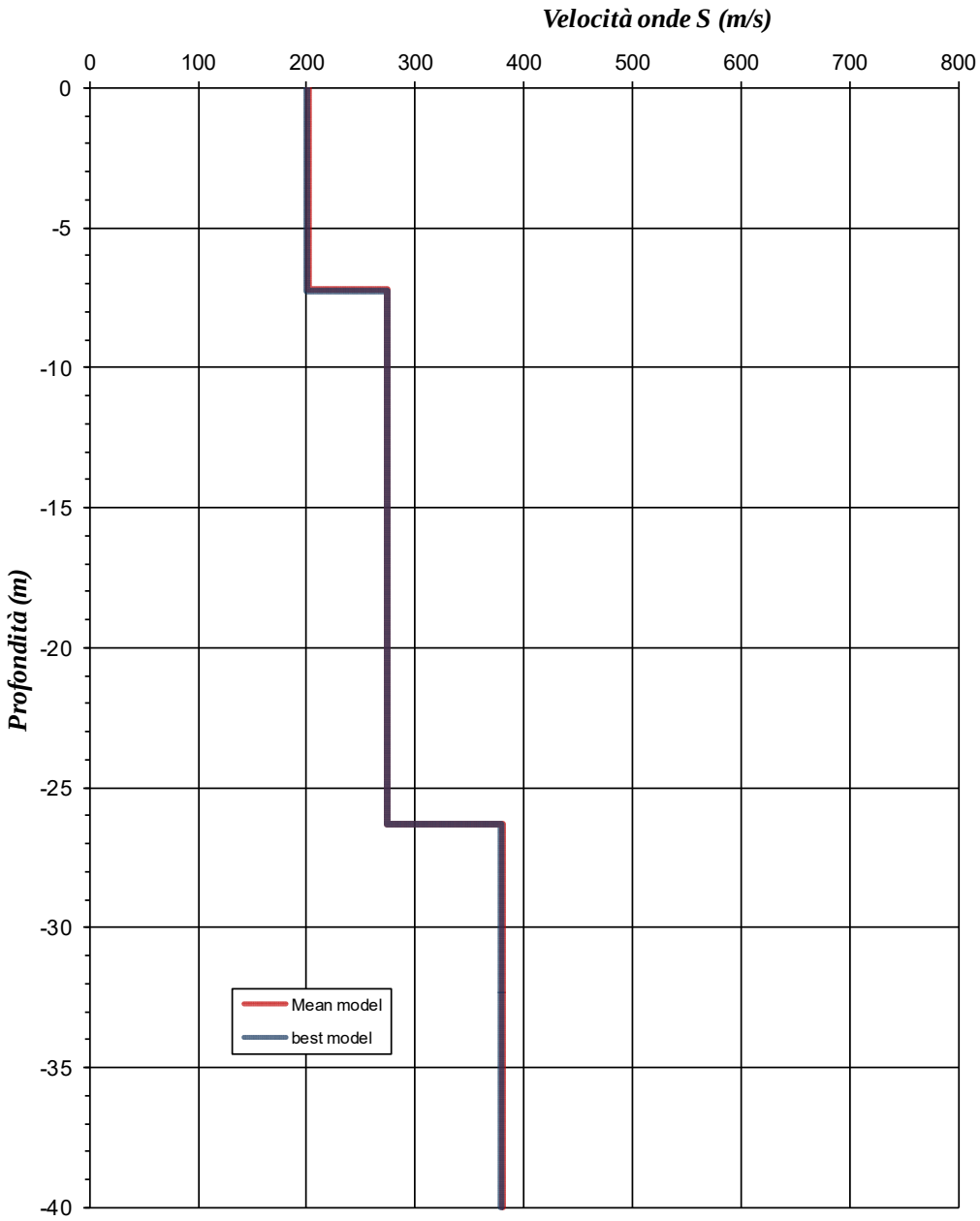


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 11					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	7,2	200	0	7,2	201
7,2	26,3	273	7,2	26,3	274
26,3	40	379	26,3	40	381
Vseq = 260 m/s			Vseq = 260 m/s		

MASW 12

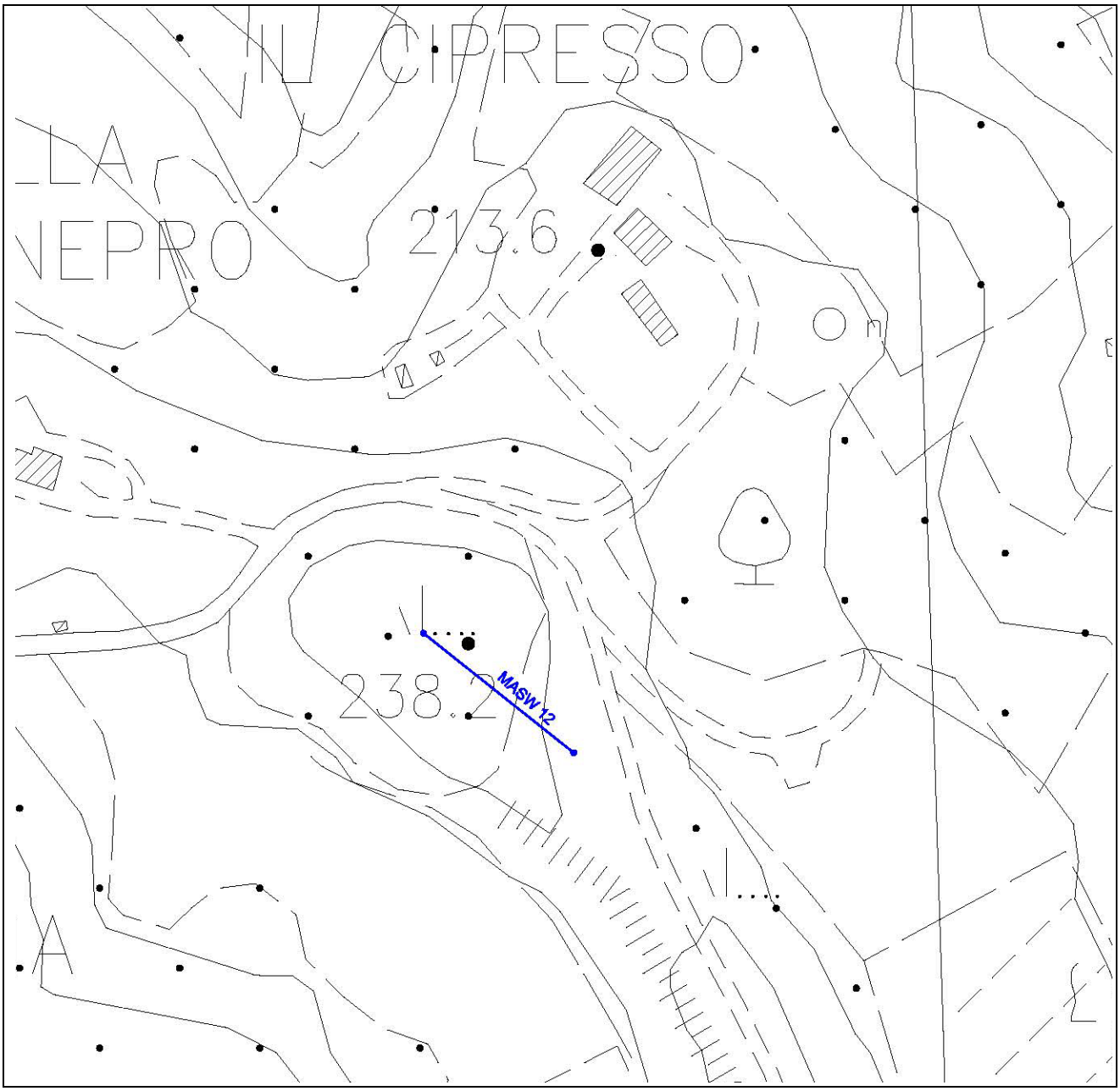


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

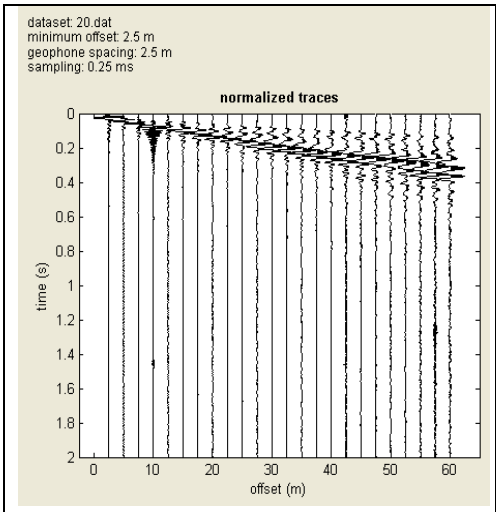


Figura: Sismogramma

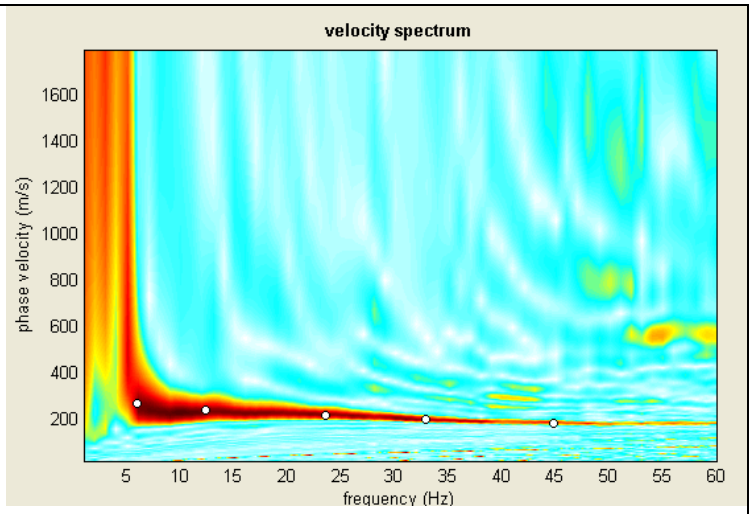
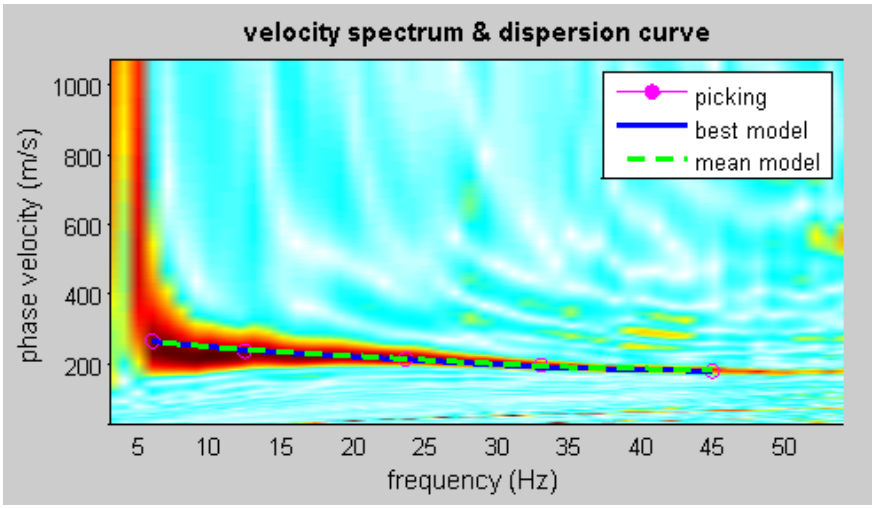


Figura: Spettro di velocità con curva di dispersione e picking



MASW Montevarchi 12

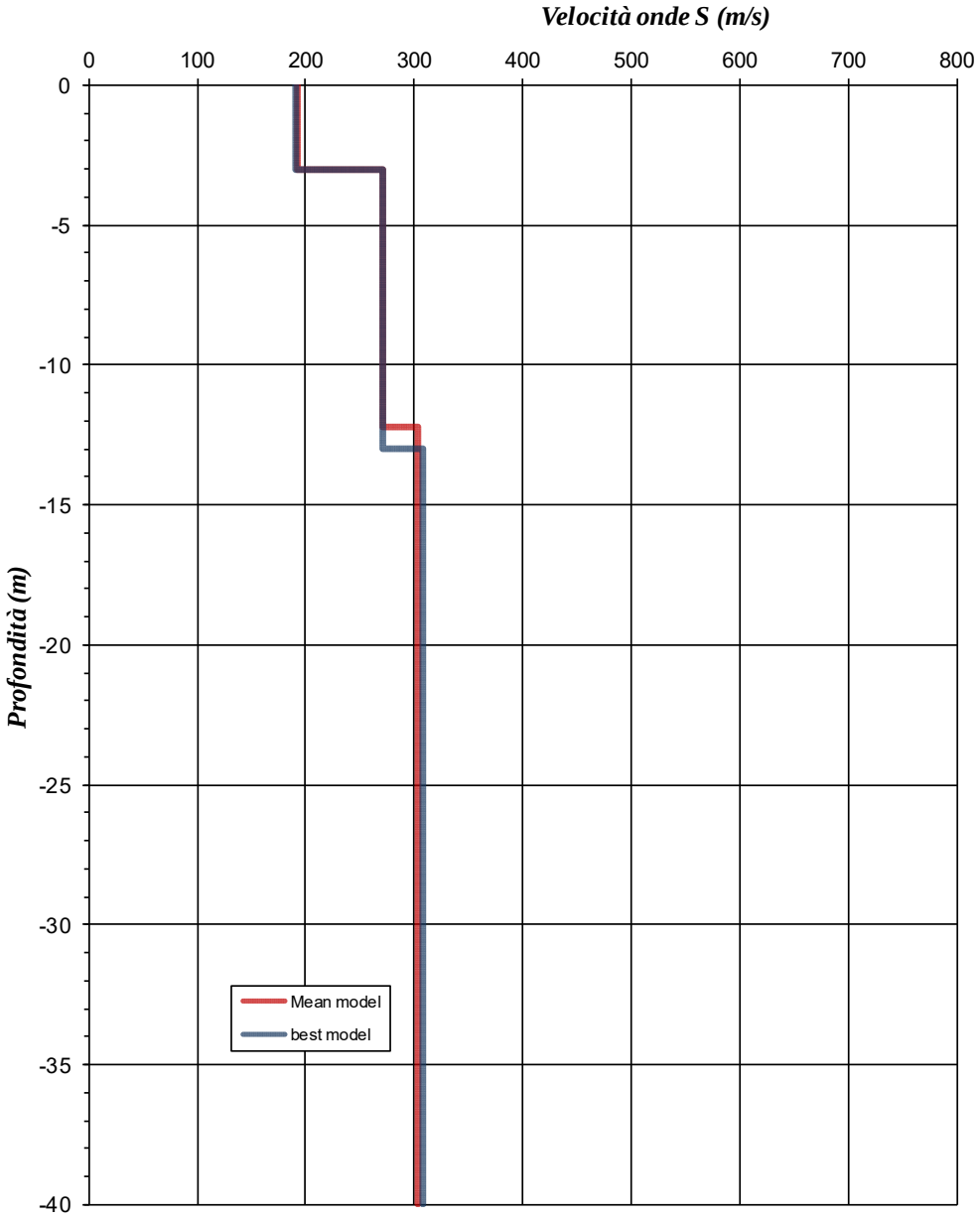


Figura: modello interpretativo

L'interpretazione della prova MASW, relativamente alle onde S, ha reso evidente le seguenti successioni:

PROVA MASW – Montevarchi 12					
Best model			**Mean model**		
Profondità da P.C (m)		**Velocità Onde S (m/s)**	**Profondità da P.C (m)**		**Velocità Onde S (m/s)**
0	3,0	190	0	3,0	193
3,0	13,0	271	3,0	12,2	271
13,0	40	308	12,2	40	304
Vseq = 278 m/s			Vseq = 278 m/s		

Profilo A

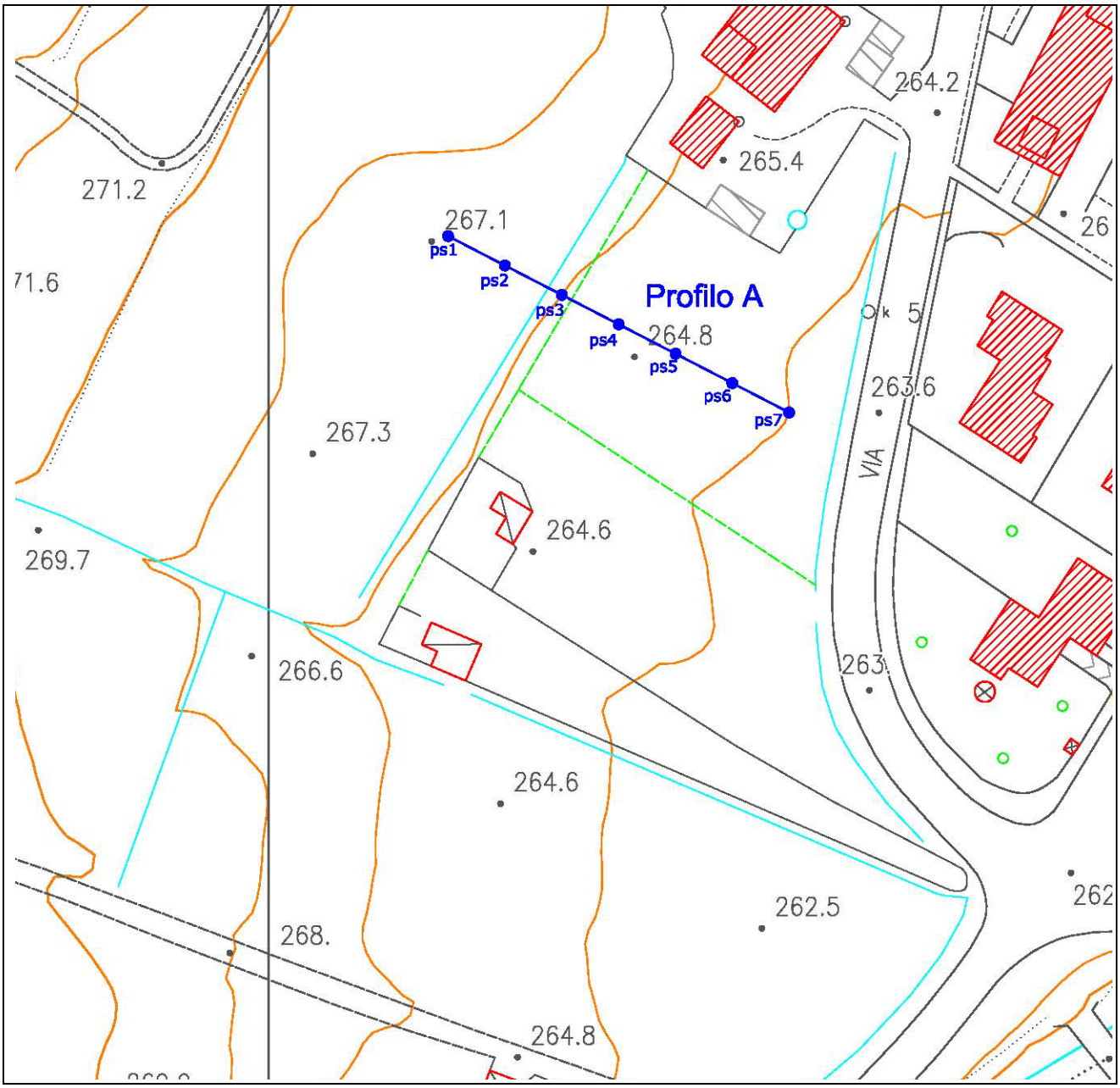
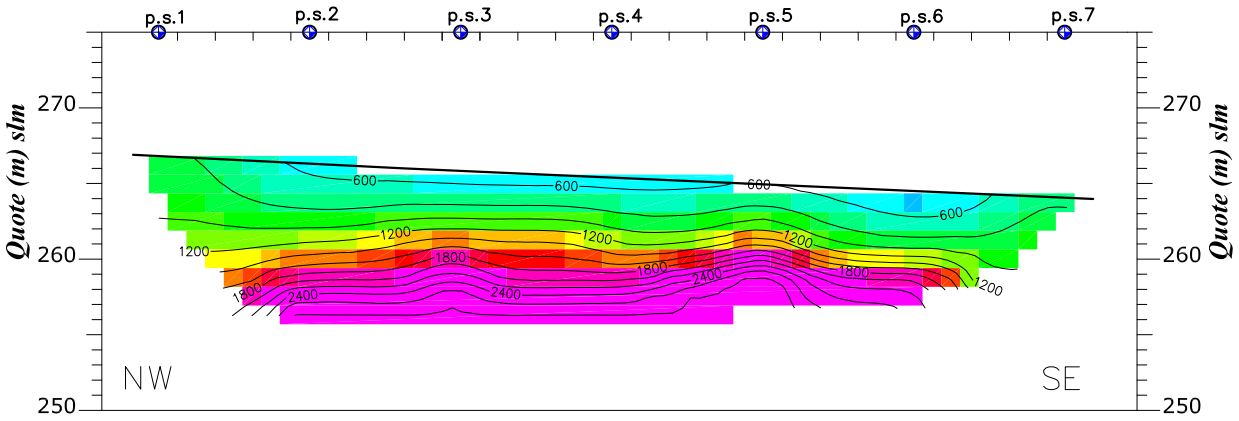


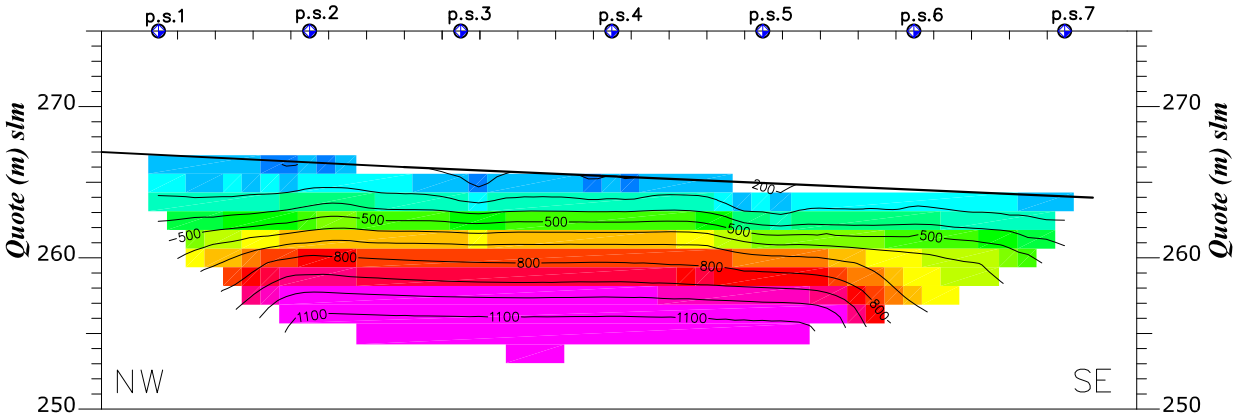
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

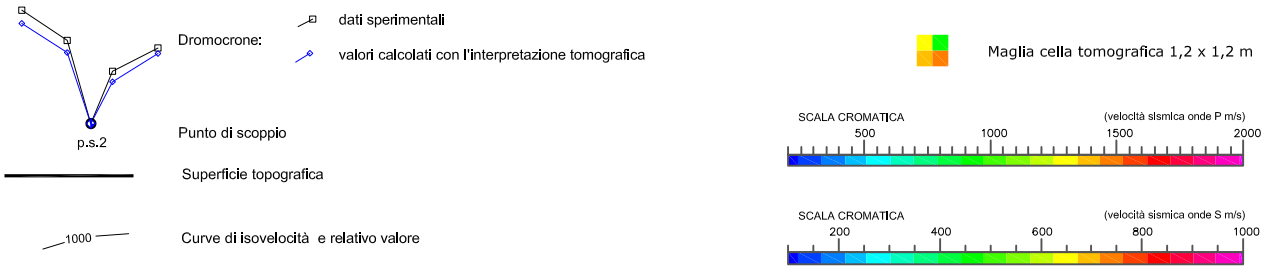
PROFILO SISMICO A onde P



PROFILO SISMICO A onde S



LEGENDA:



Profilo B

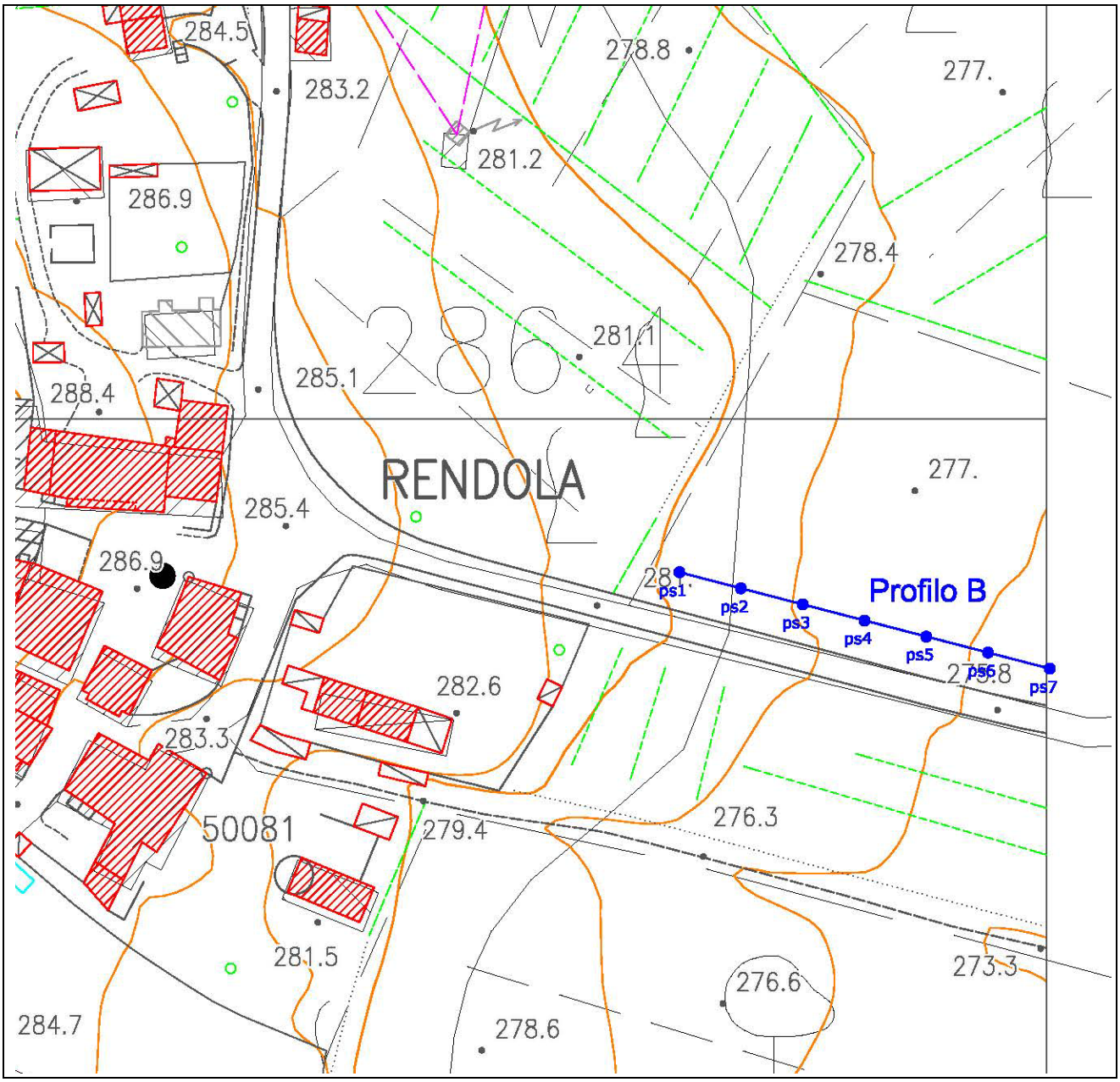
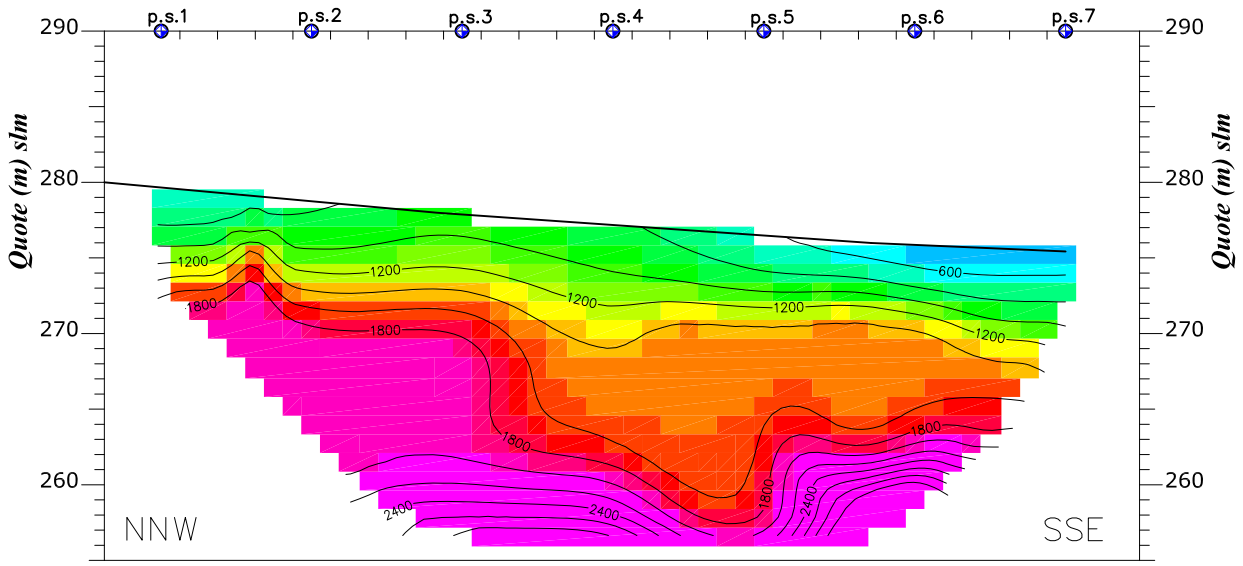


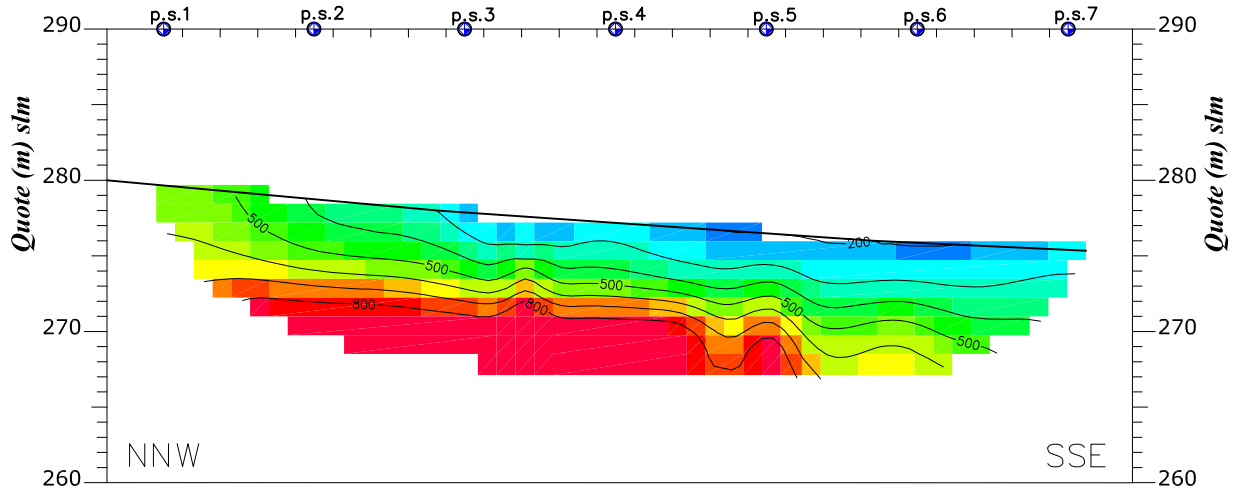
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

PROFILO SISMICO B onde P



PROFILO SISMICO B onde S



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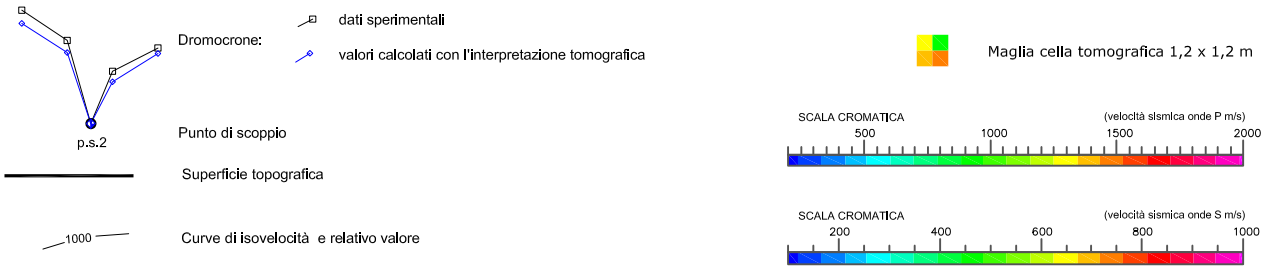


Profilo C

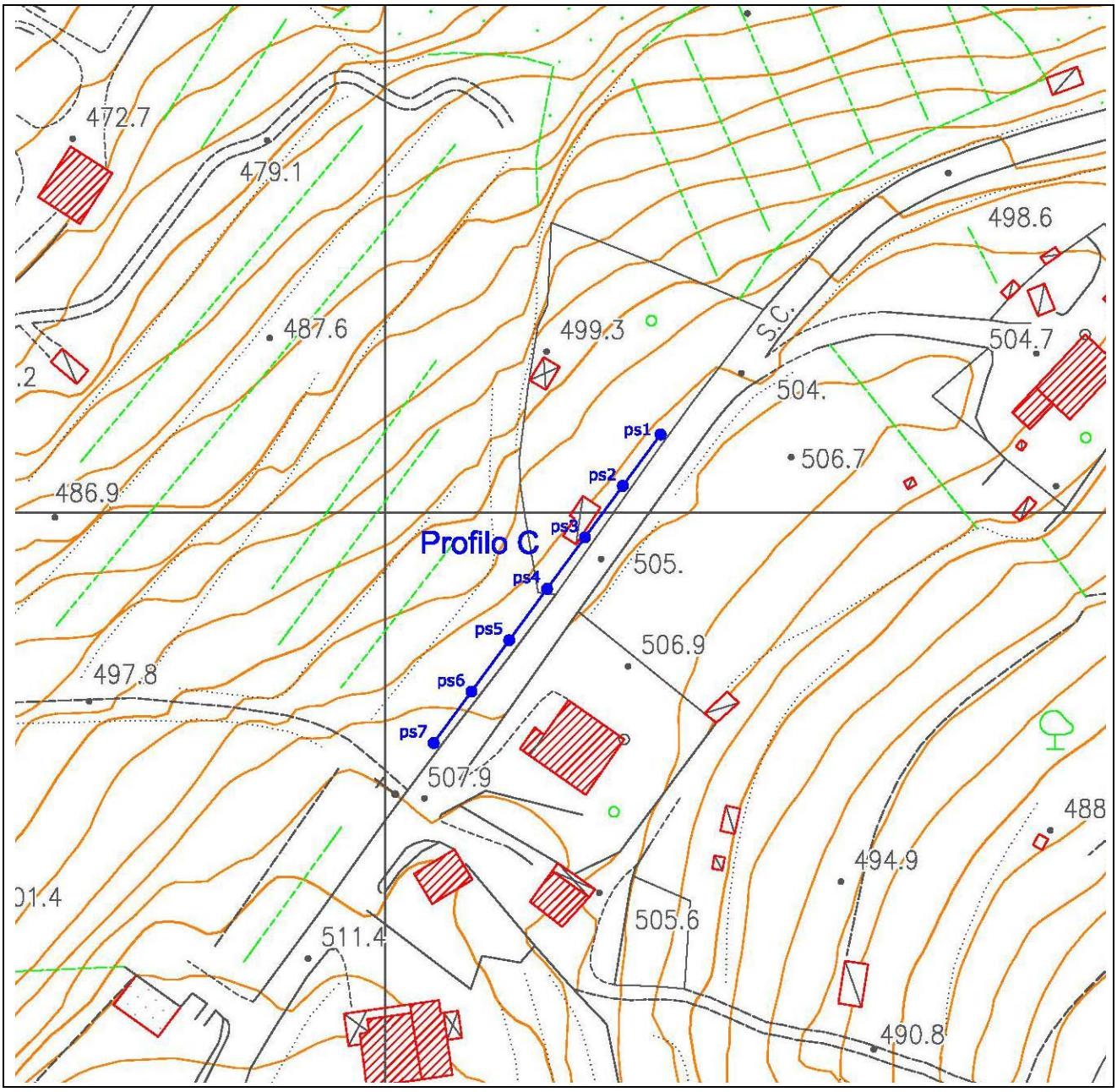
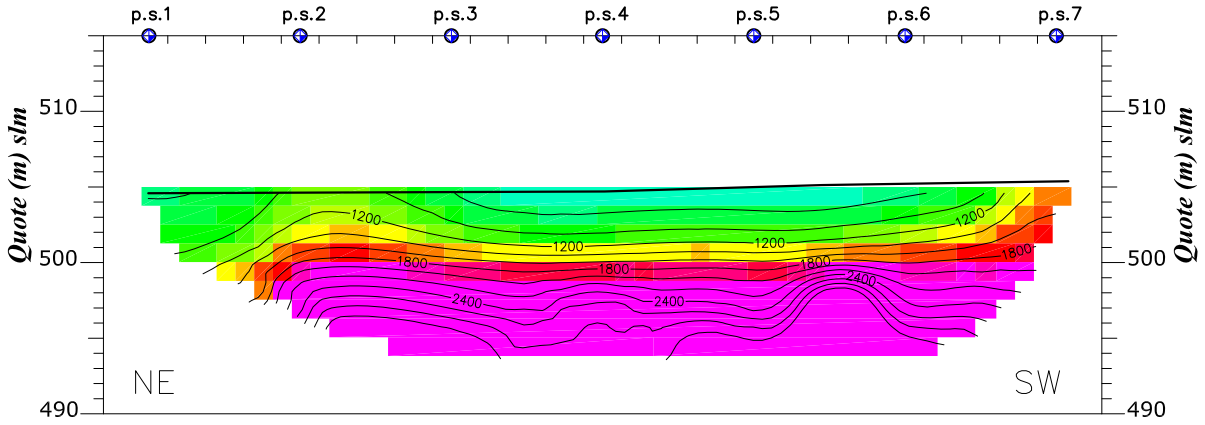


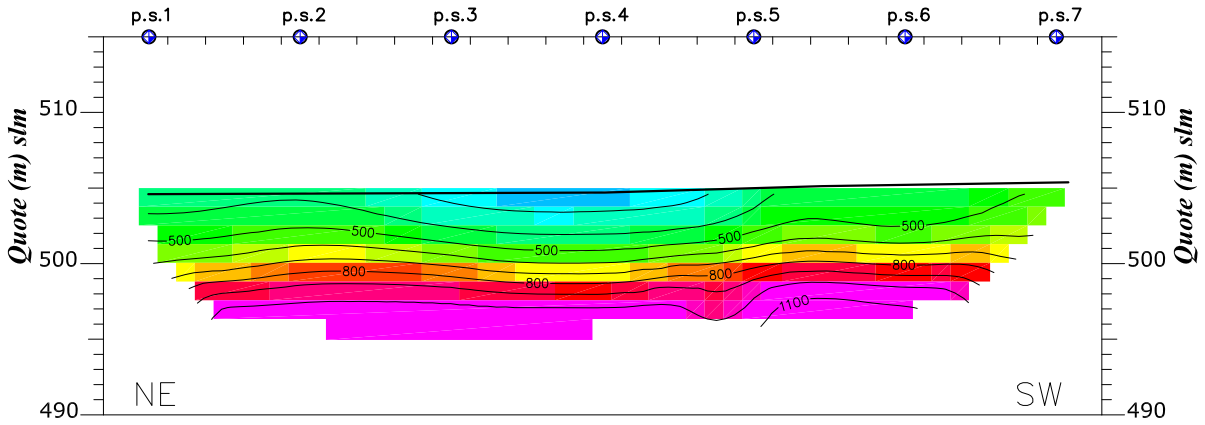
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

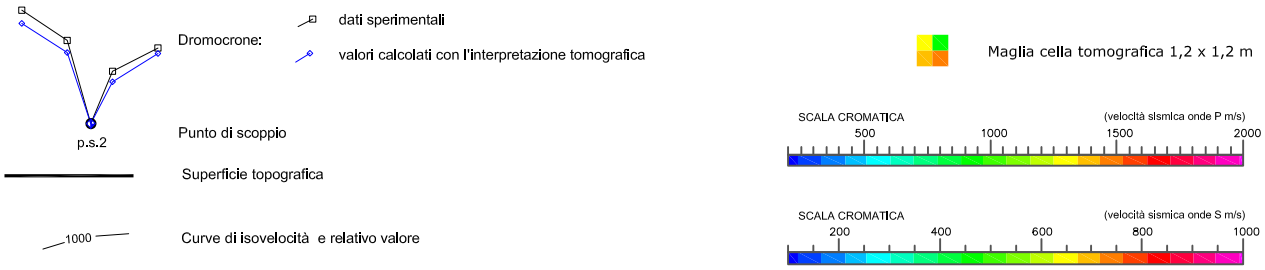
PROFILO SISMICO C onde P



PROFILO SISMICO C onde S



LEGENDA:



Profilo D

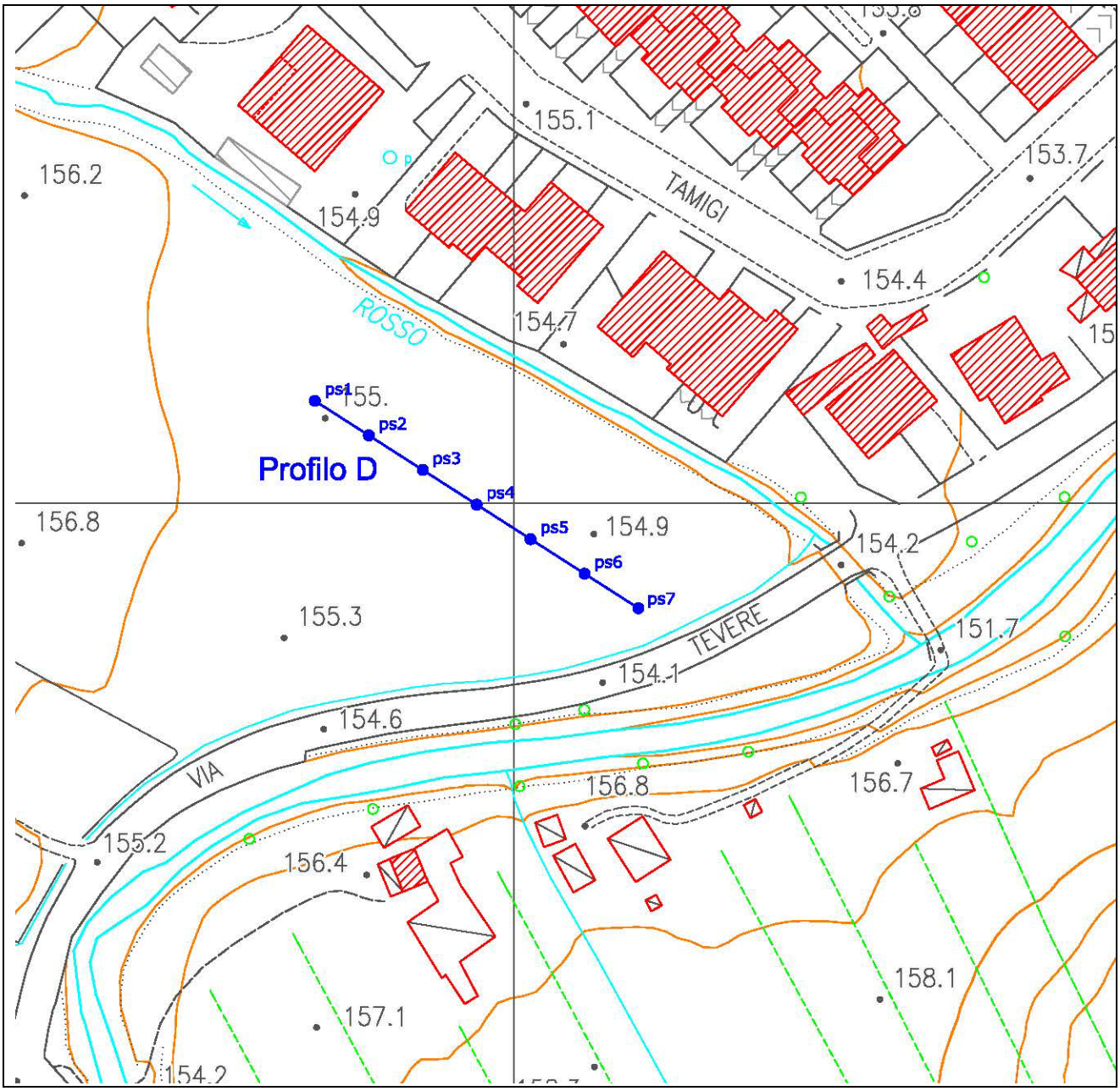
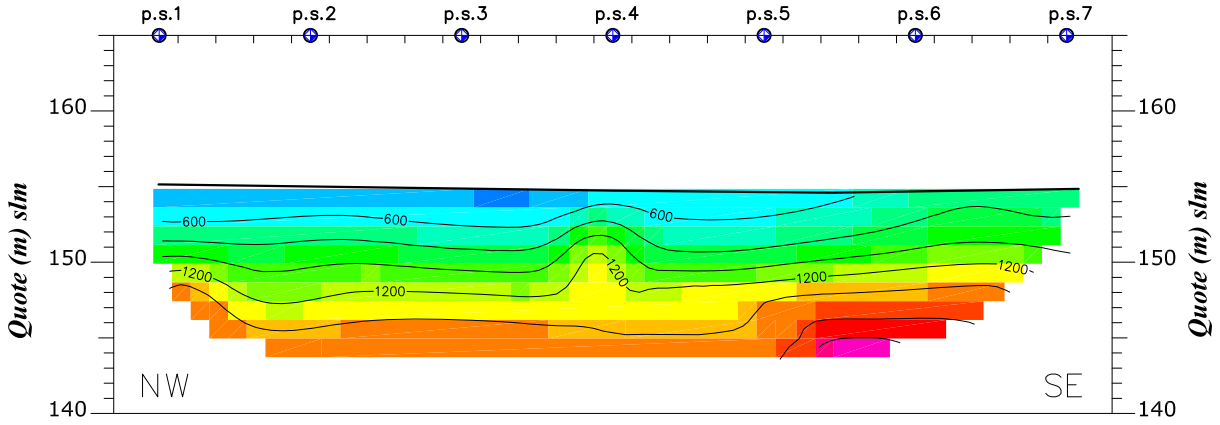


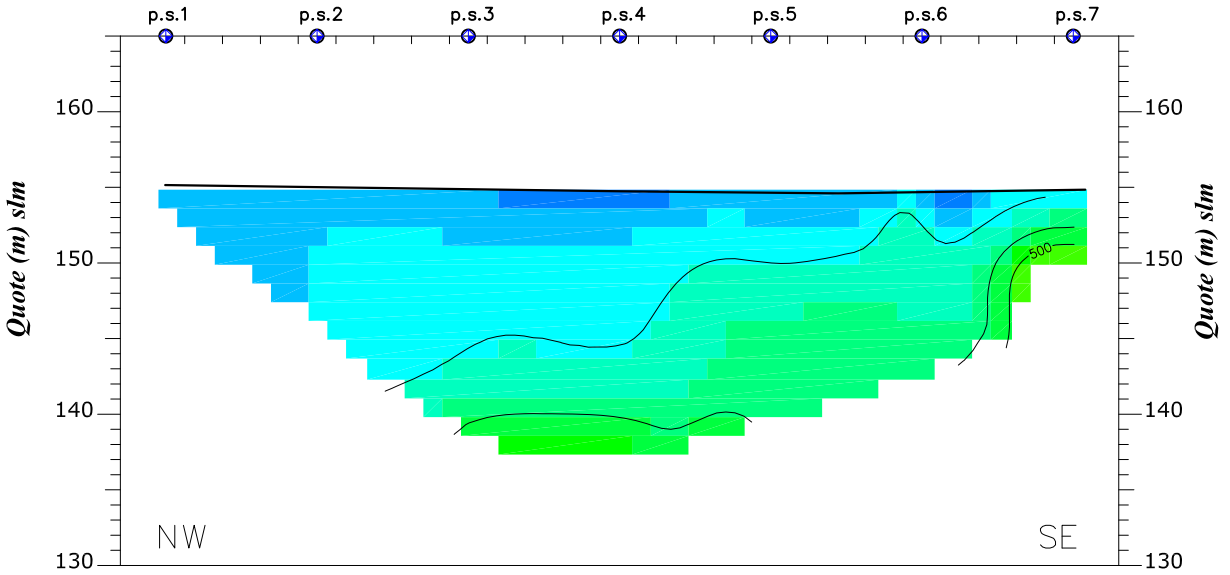
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

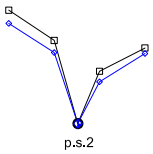
PROFILO SISMICO D onde P



PROFILO SISMICO D onde S



LEGENDA:



Dromocrone:

dati sperimentali

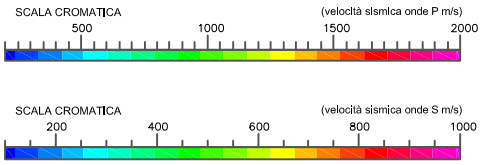
valori calcolati con l'interpretazione tomografica

Punto di scoppio

Superficie topografica

1000 Curve di isovelocità e relativo valore

Maglia cella tomografica 1,2 x 1,2 m



Profilo E

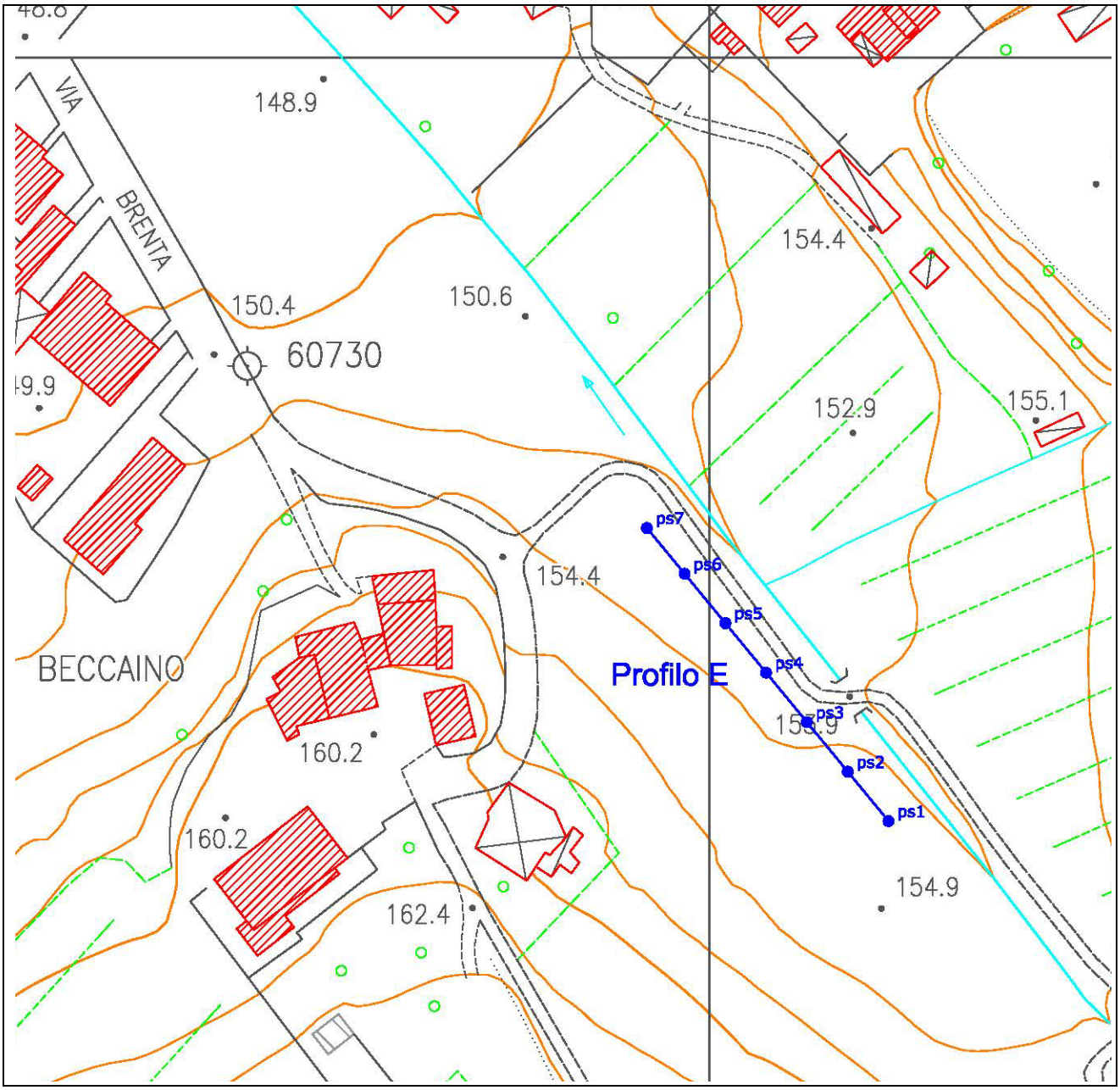
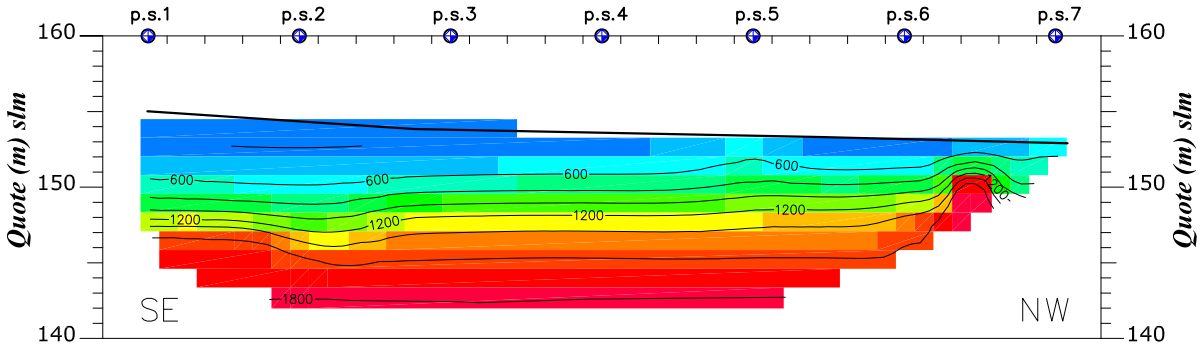


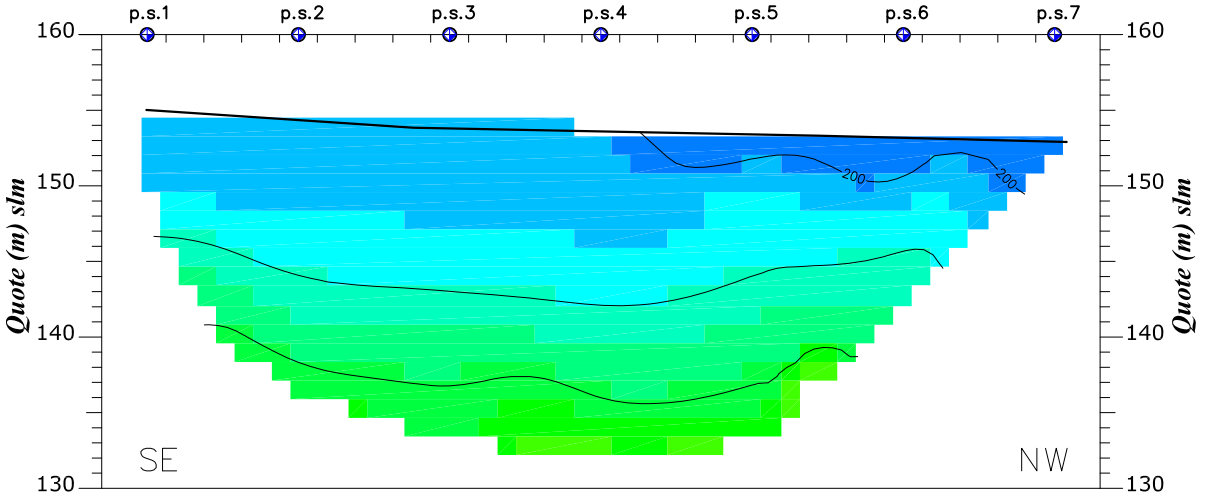
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

PROFILO SISMICO E onde P



PROFILO SISMICO E onde S



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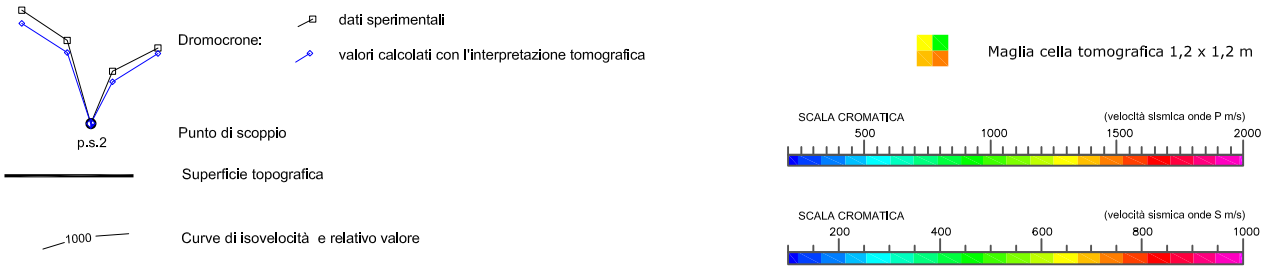


Profilo F

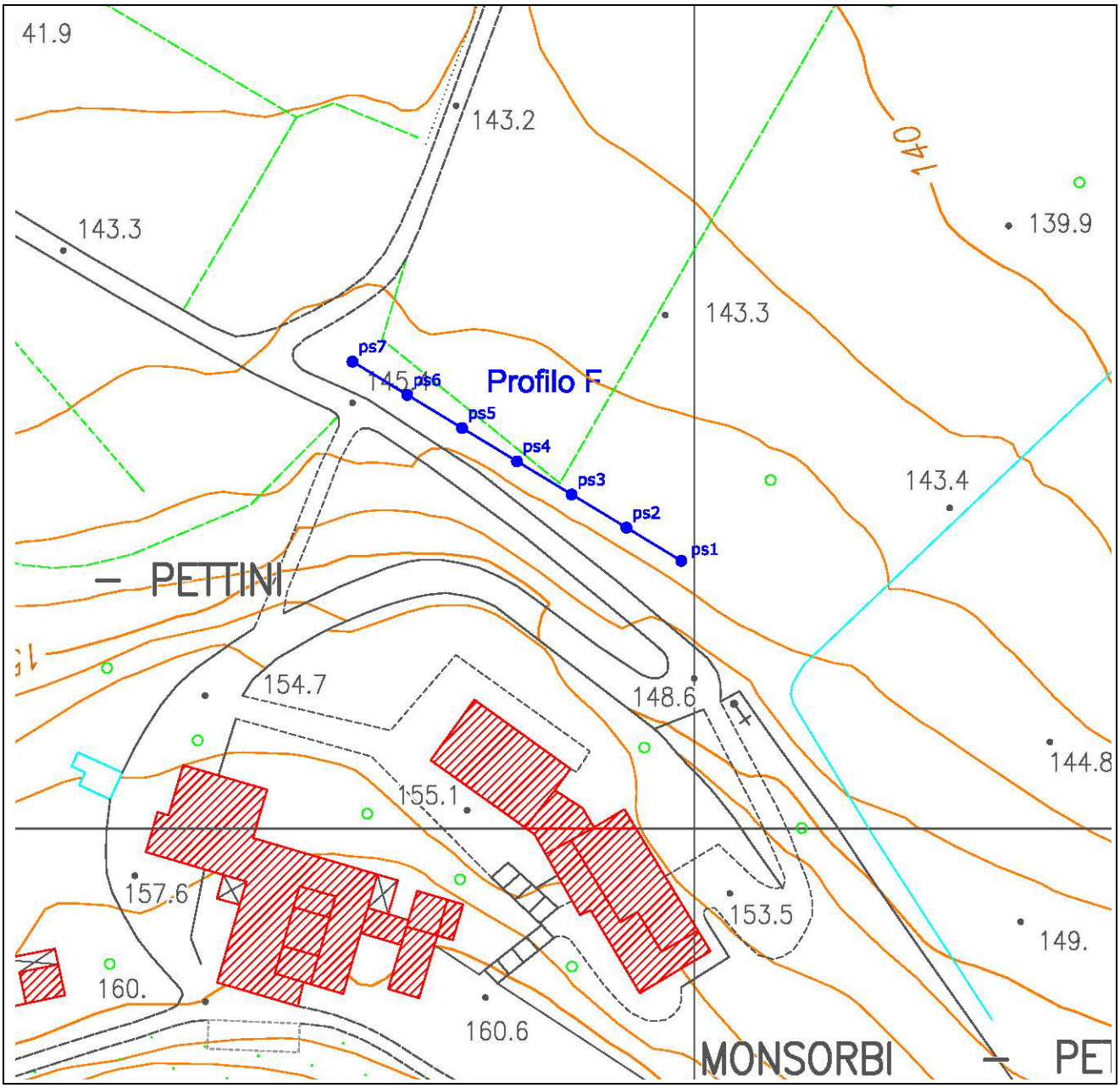
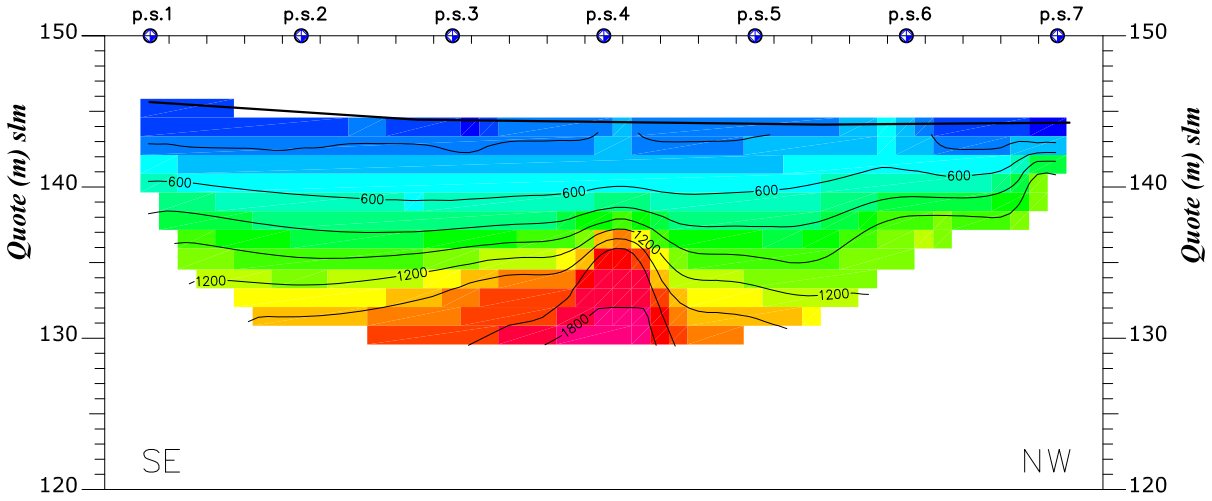


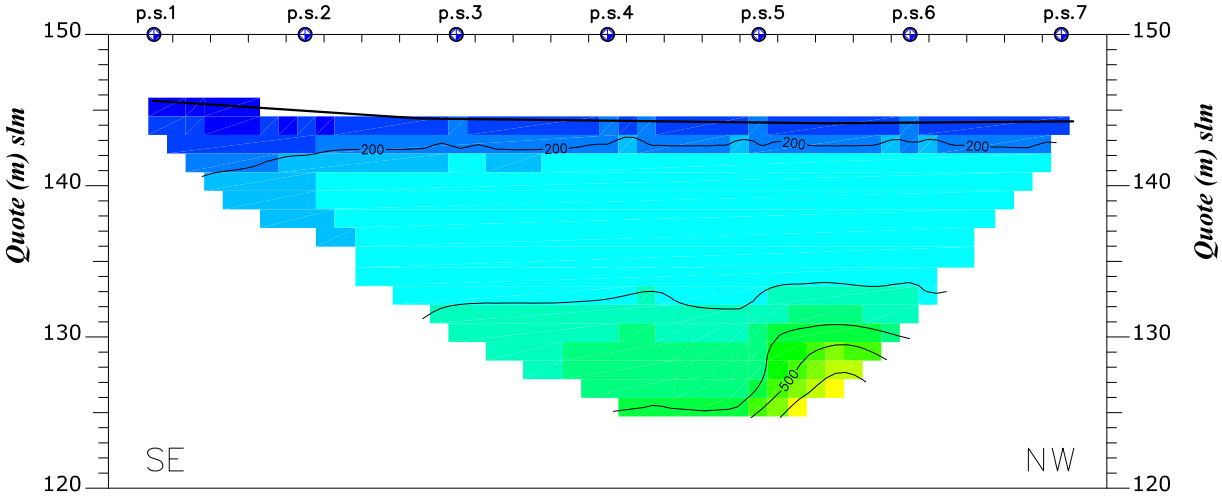
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

PROFILO SISMICO F onde P



PROFILO SISMICO F onde S



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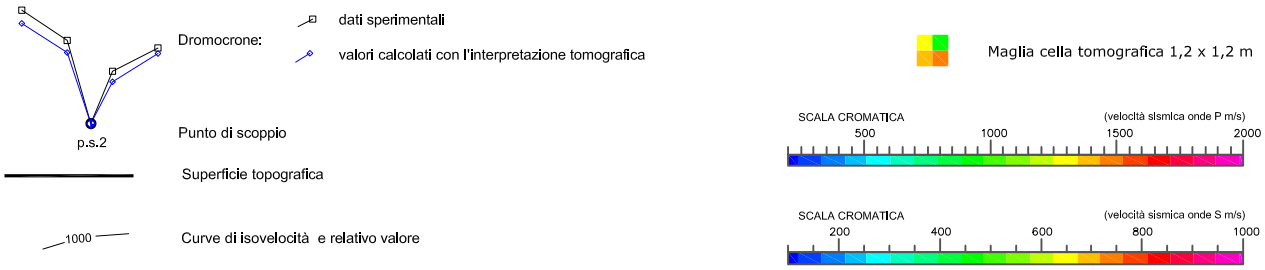


Profilo G

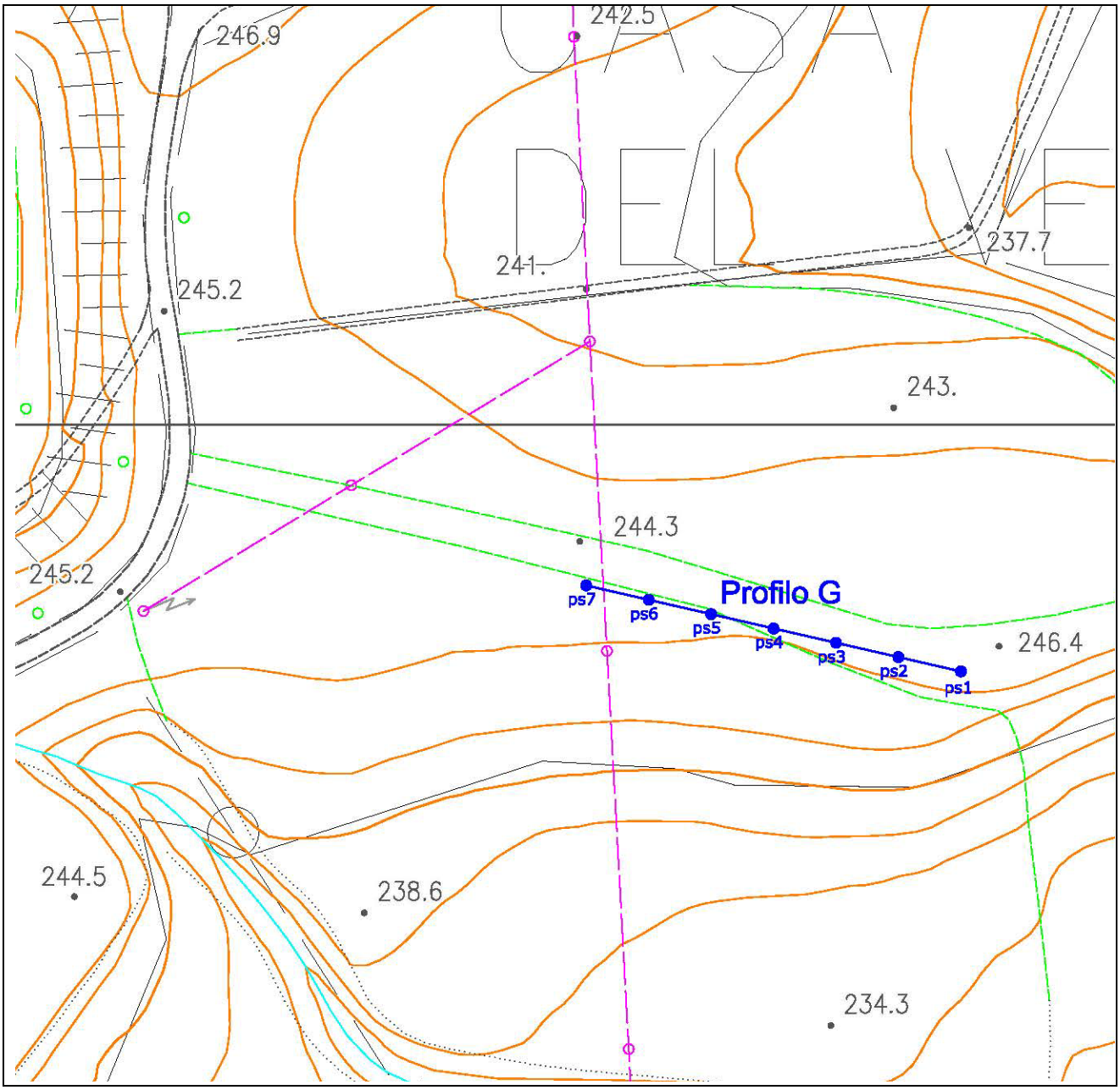
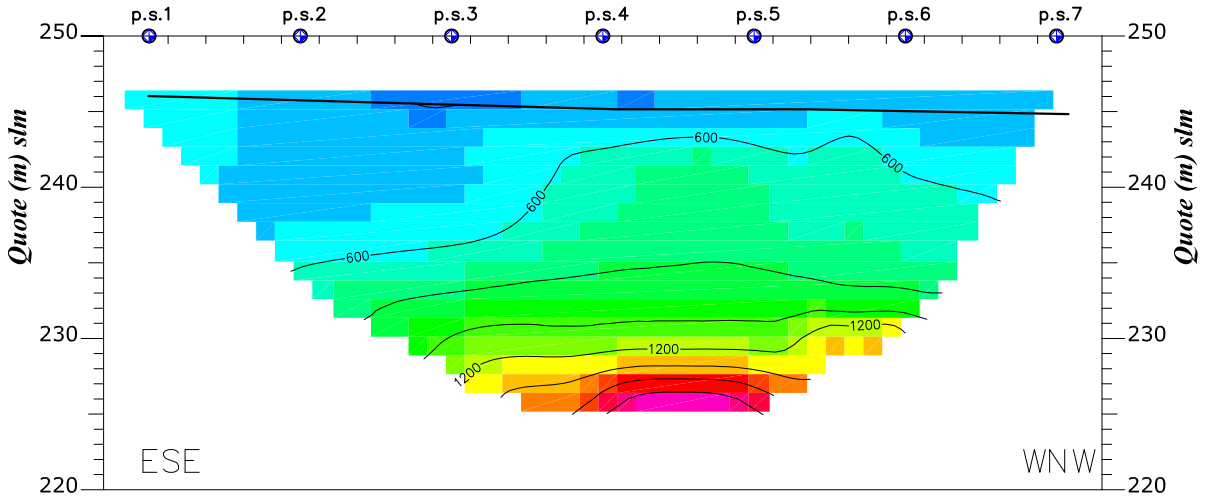


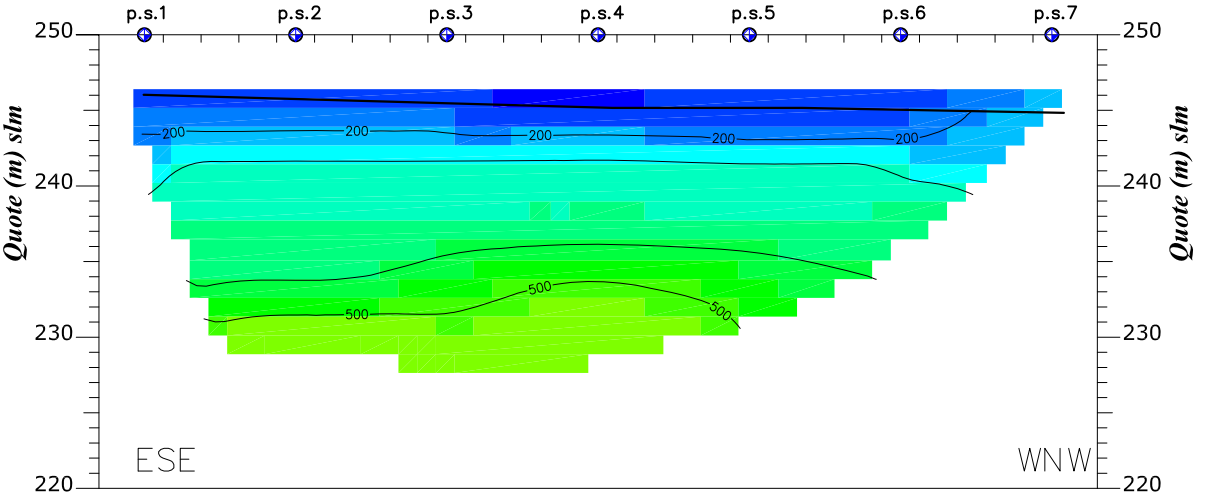
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

PROFILO SISMICO G onde P



PROFILO SISMICO G onde S



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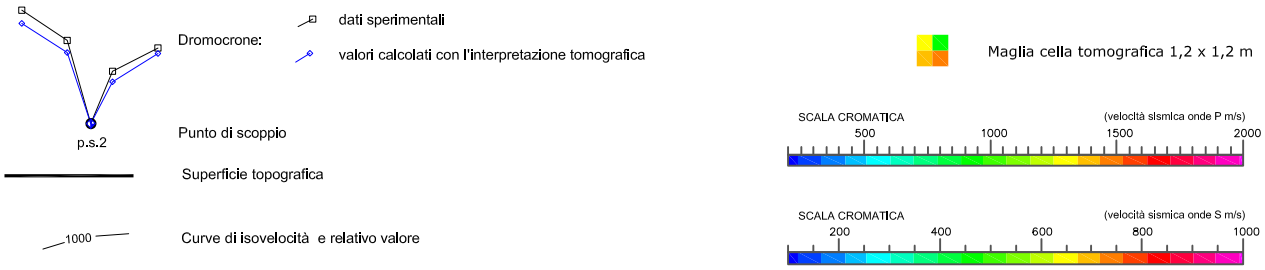


Profilo H

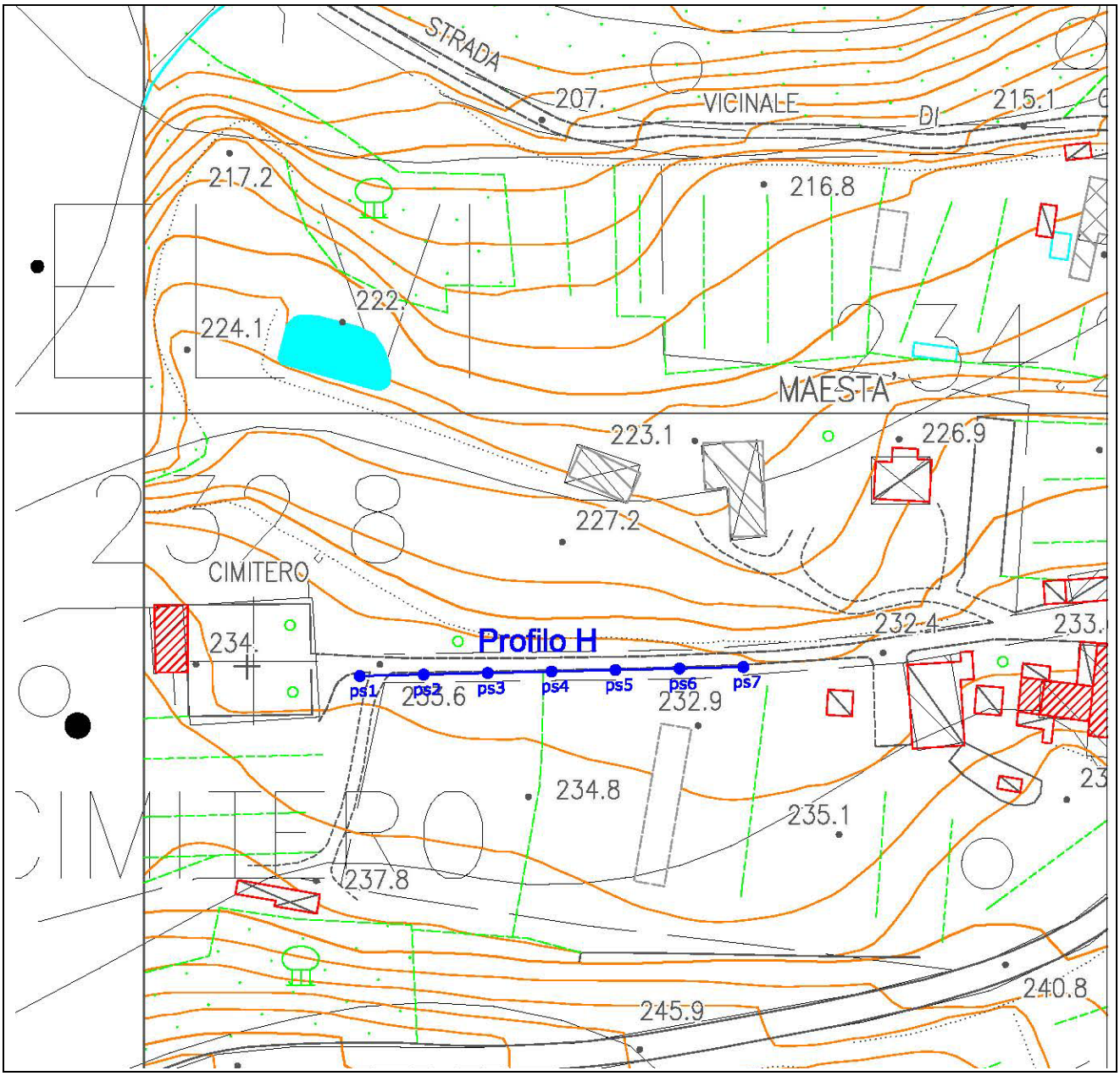
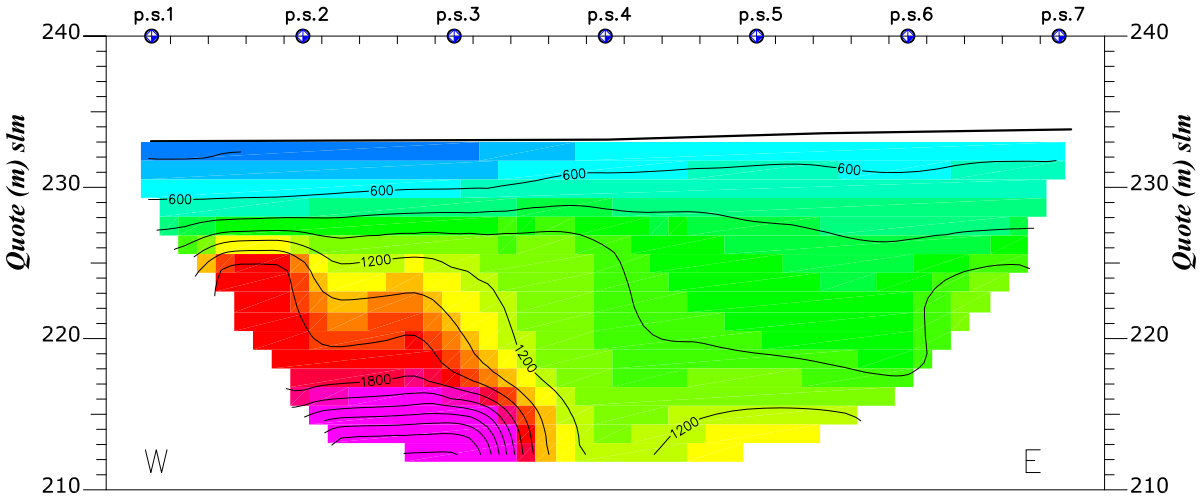


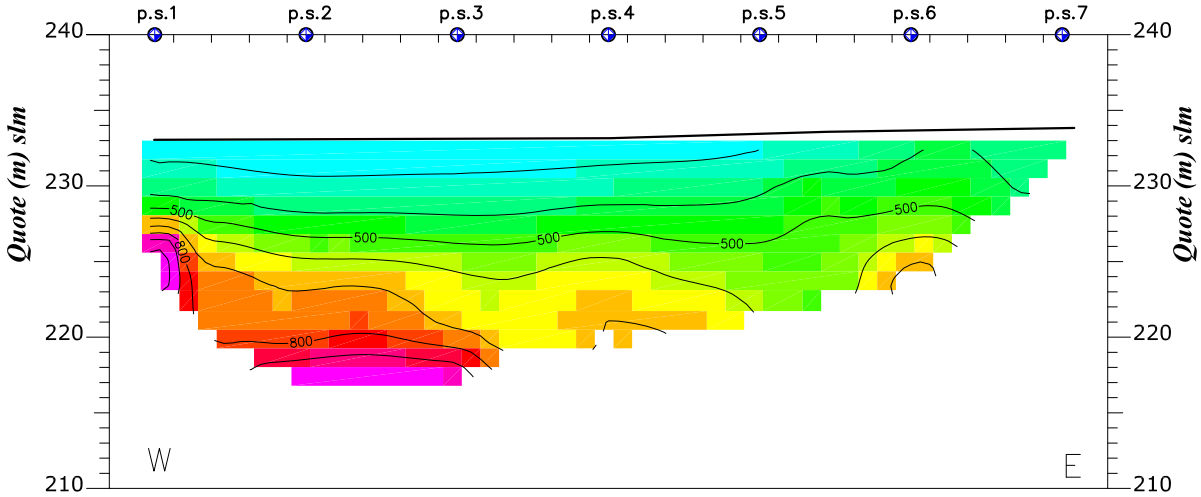
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

PROFILO SISMICO H onde P



PROFILO SISMICO H onde S



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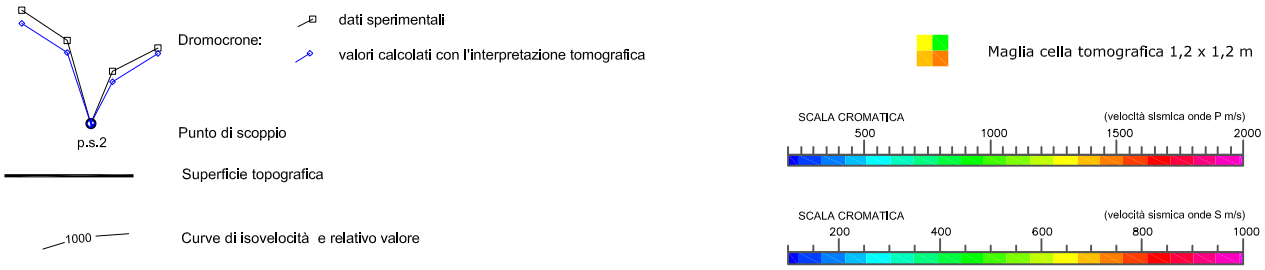


Profilo I

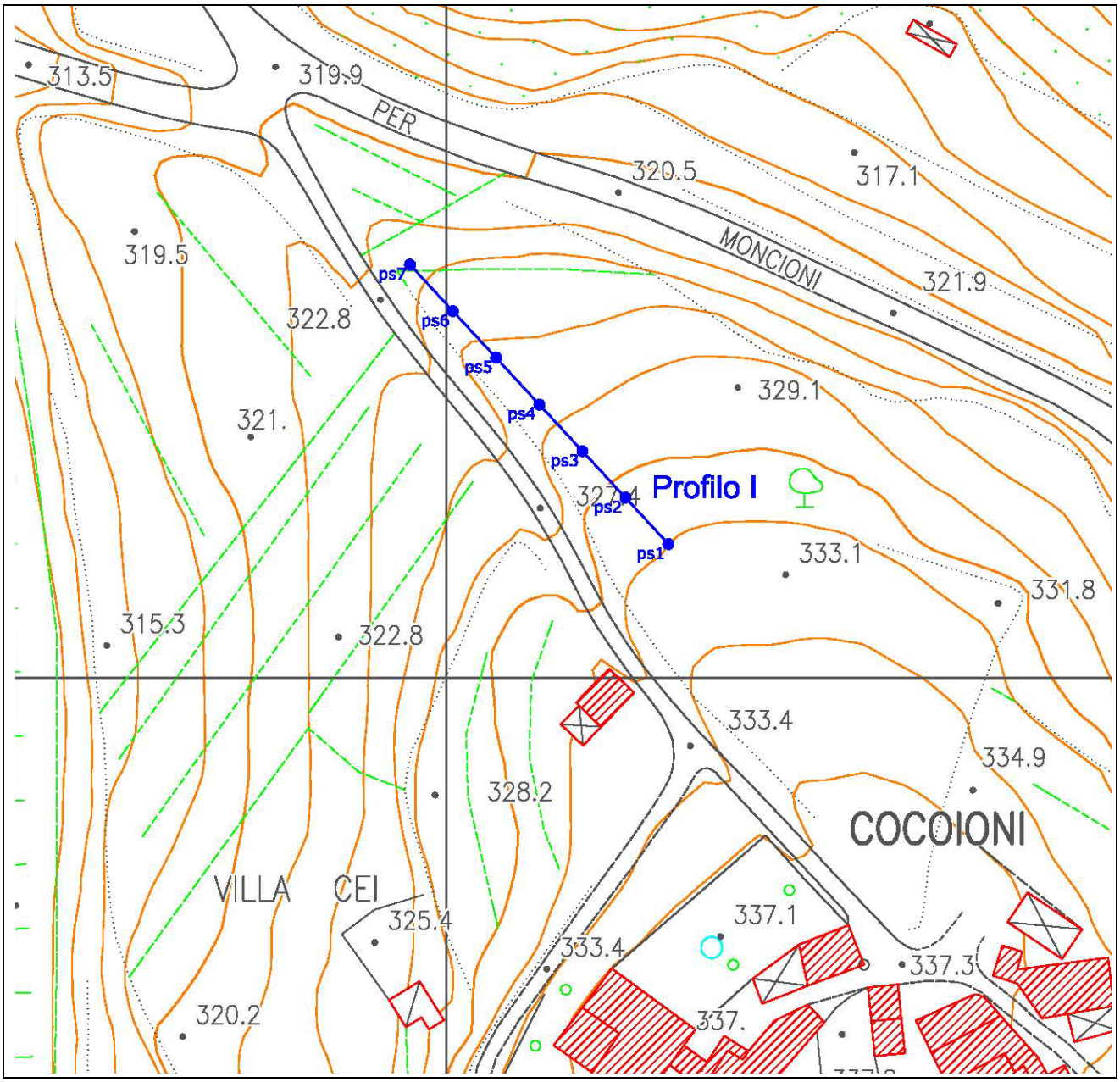
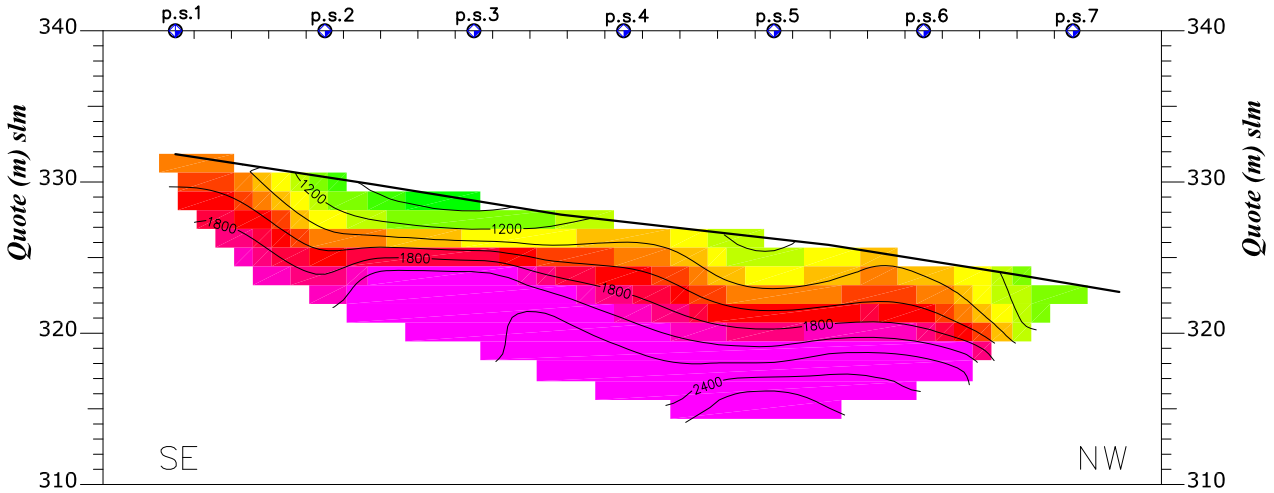


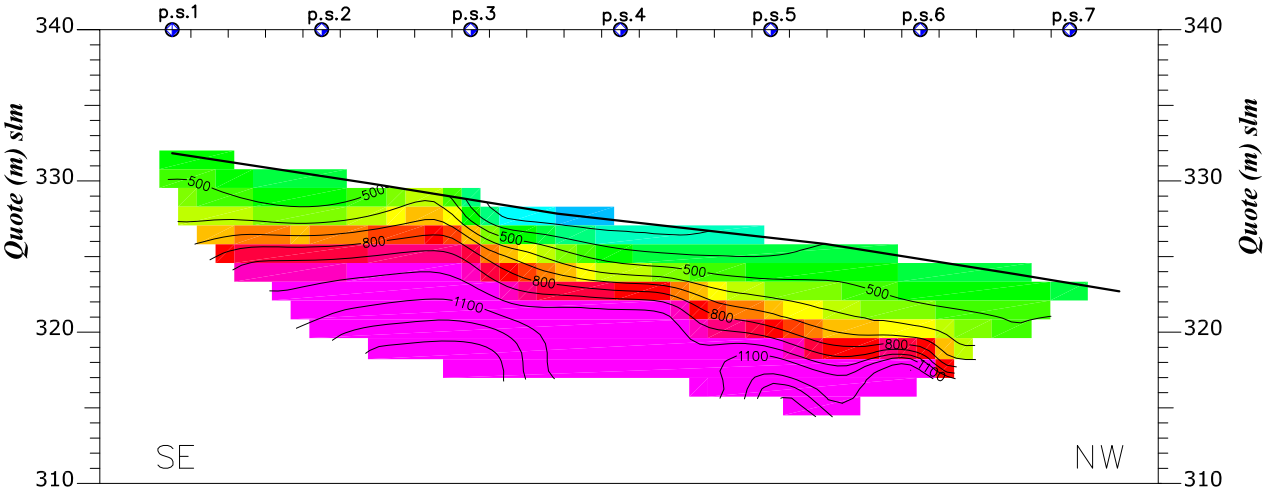
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

PROFILO SISMICO I onde P



PROFILO SISMICO I onde S



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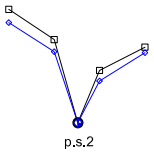


Dromocrone:

dati sperimentali

valori calcolati con l'interpretazione tomografica

Punto di scoppio

Superficie topografica

1000 Curve di isovelocità e relativo valore

Maglia cella tomografica 1,2 x 1,2 m

SCALA CROMATICA (velocità sismica onde P m/s)

500 1000 1500 2000

SCALA CROMATICA (velocità sismica onde S m/s)

200 400 600 800 1000

Profilo L

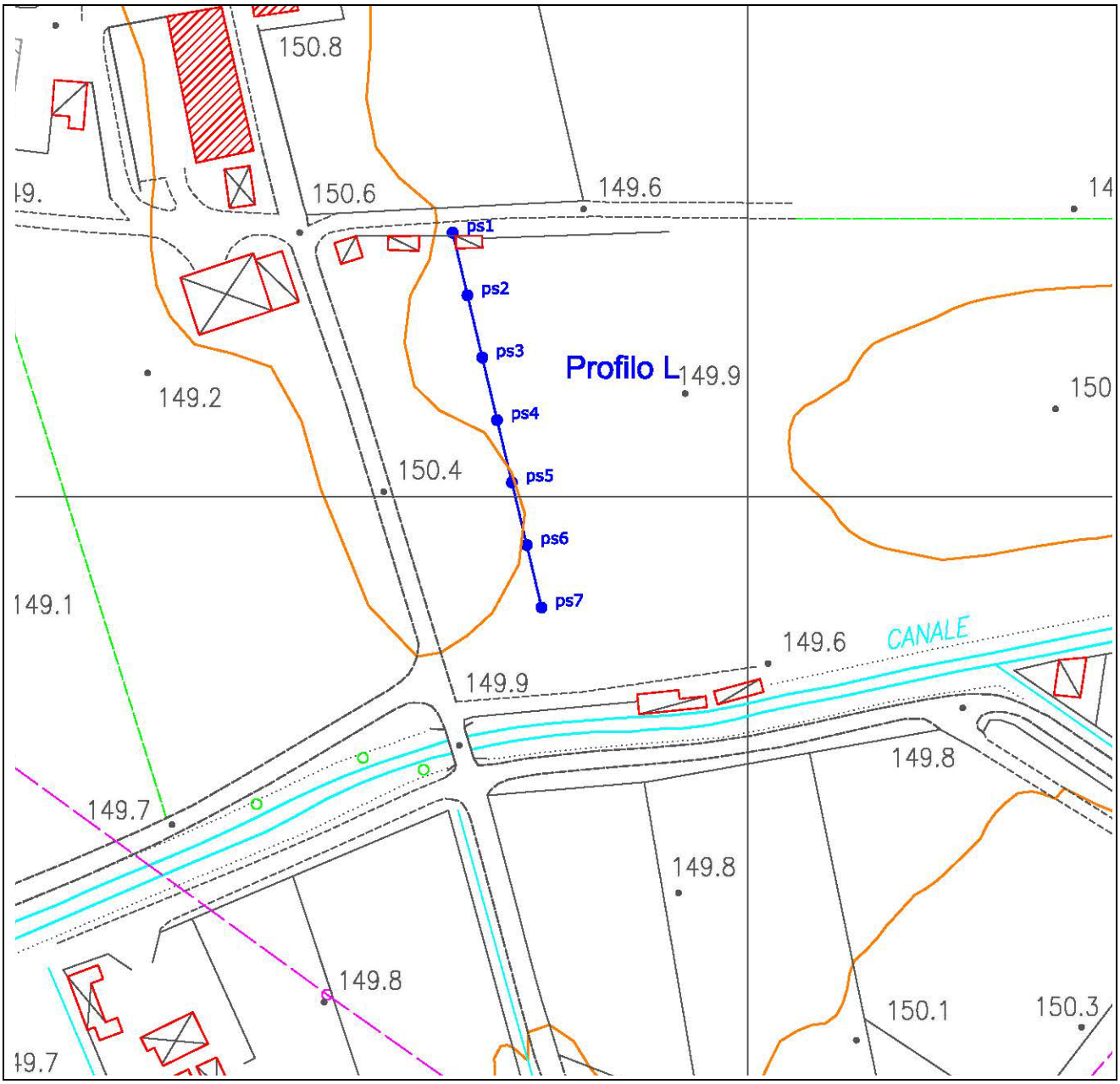
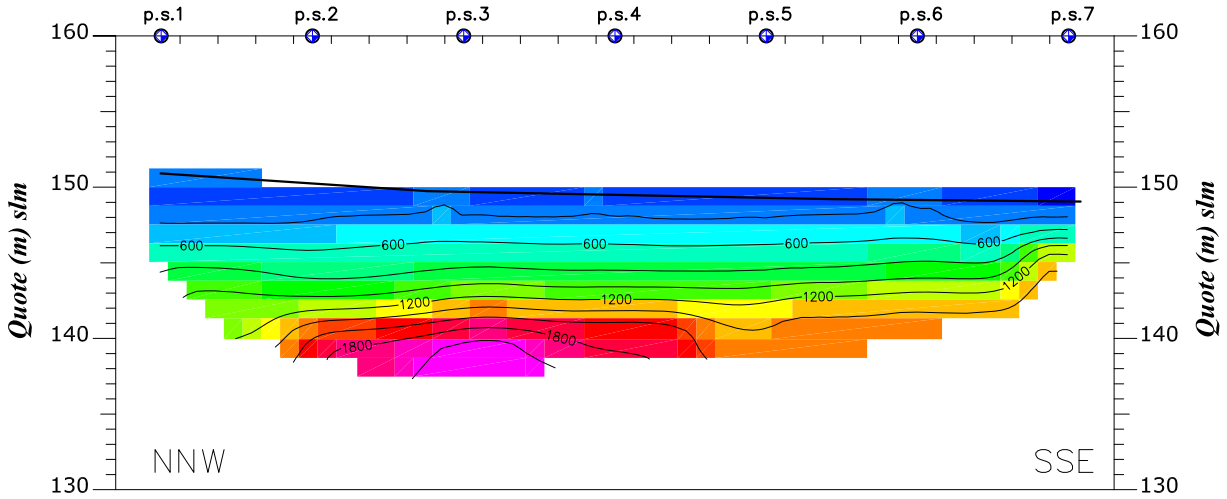


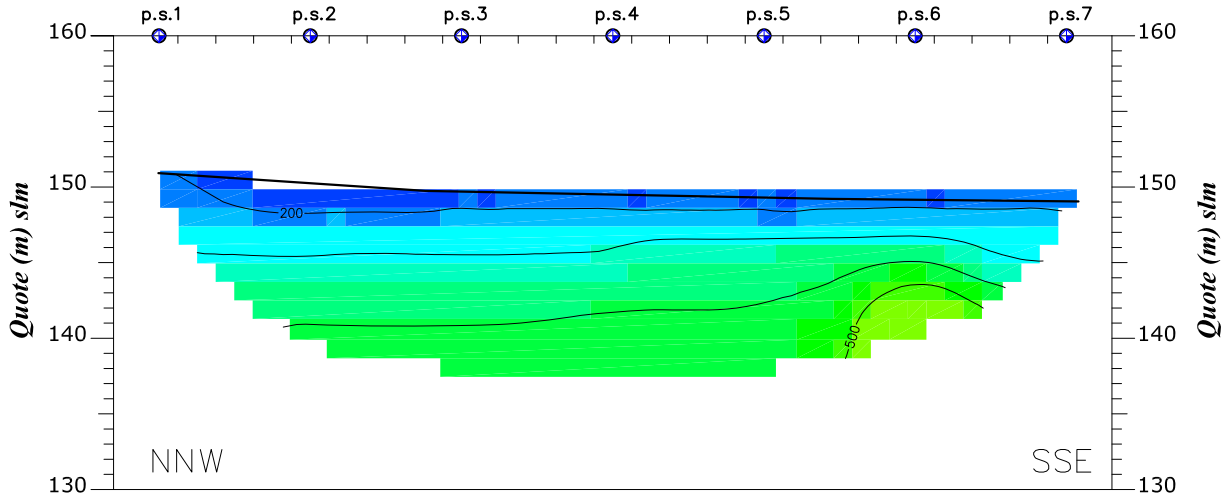
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

PROFILO SISMICO L onde P



PROFILO SISMICO L onde S



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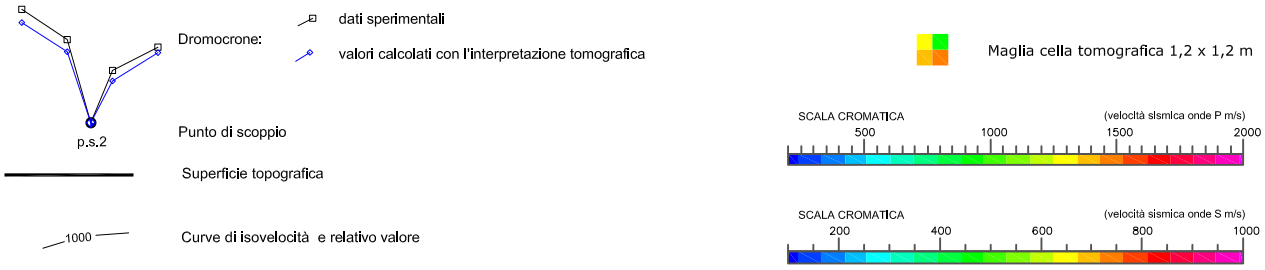


Profilo M

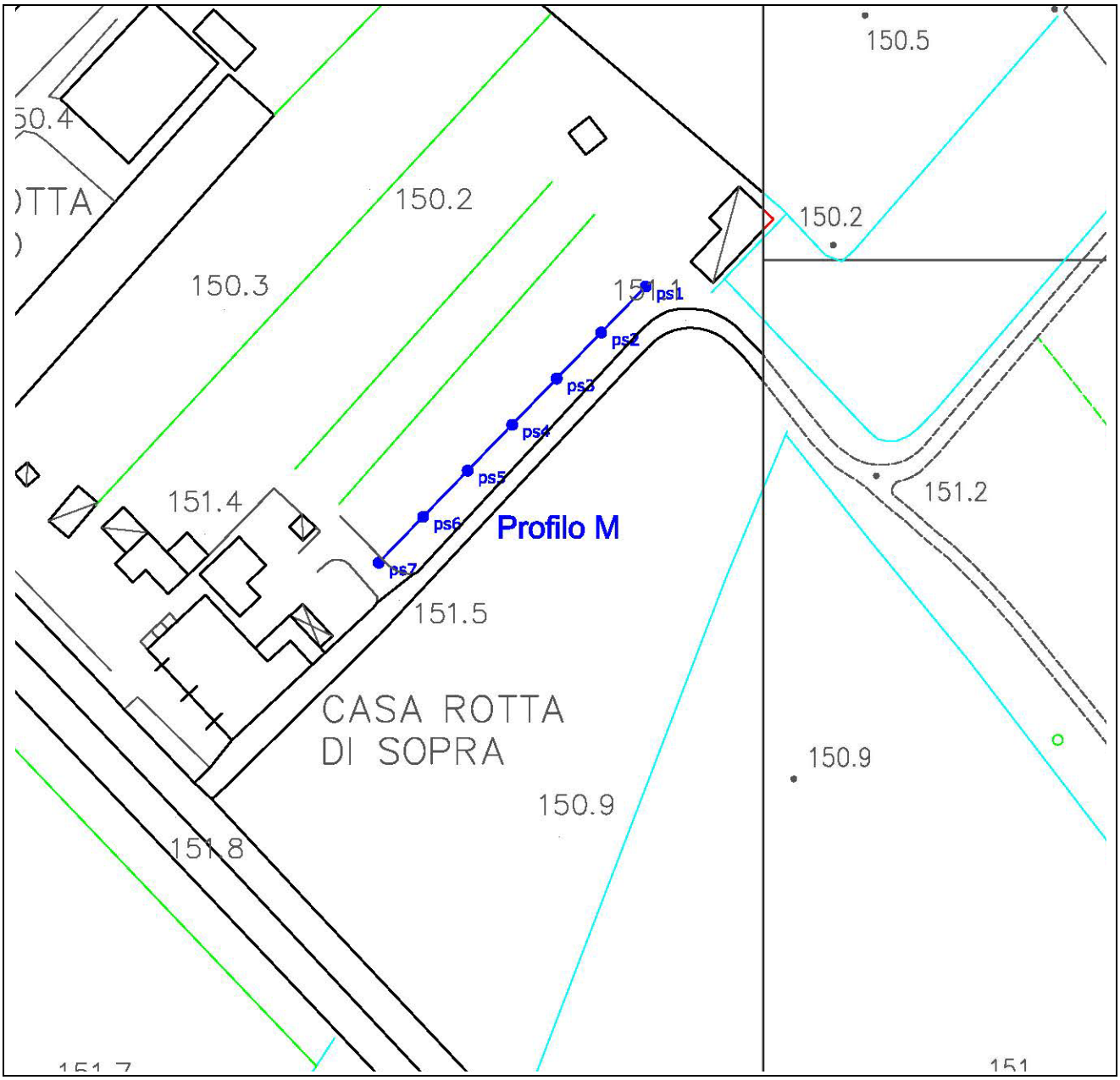
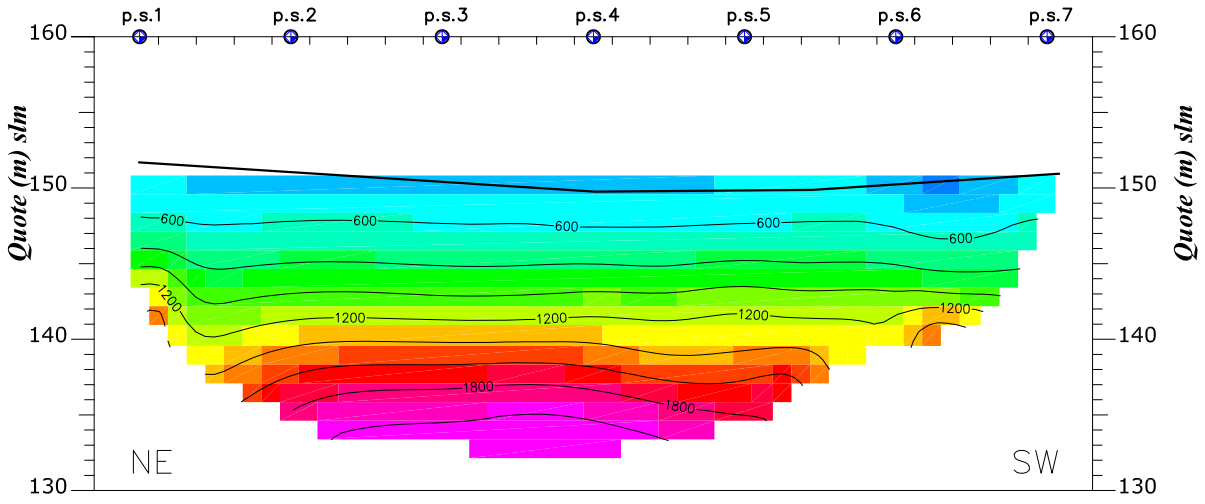


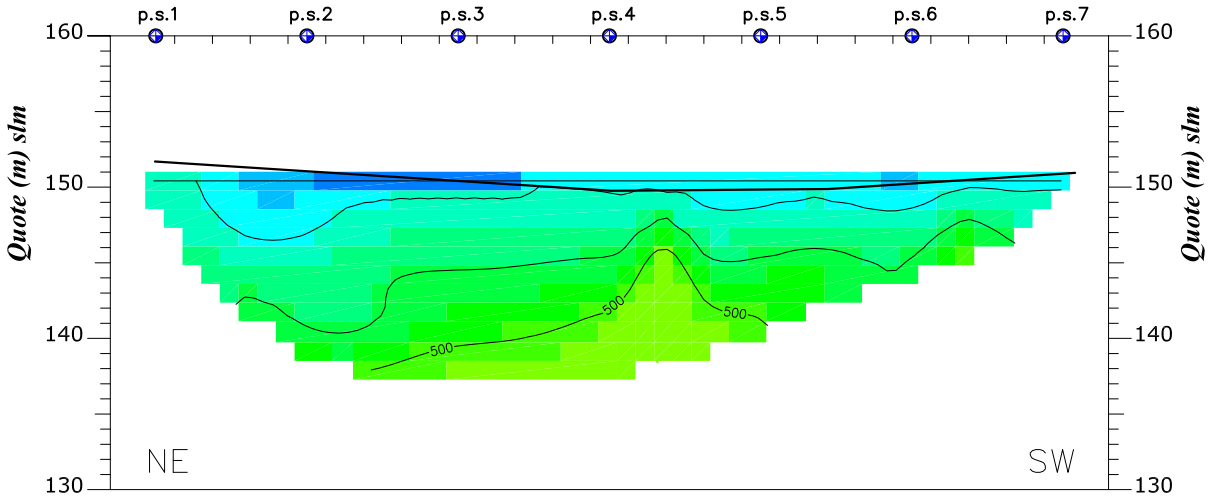
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

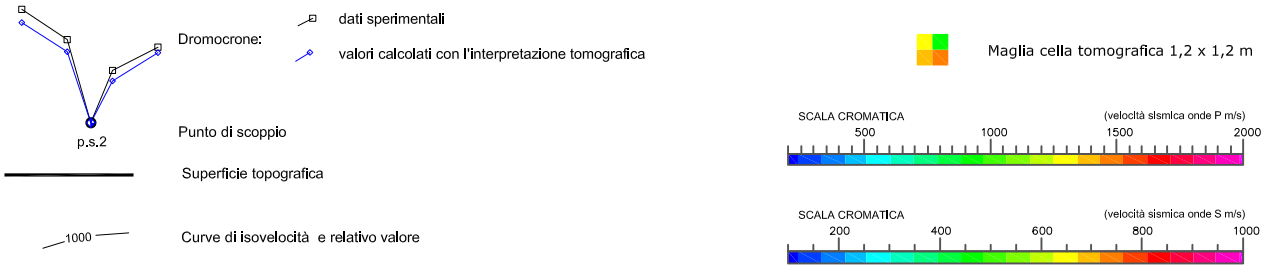
PROFILO SISMICO M onde P



PROFILO SISMICO M onde S



LEGENDA:



Profilo N

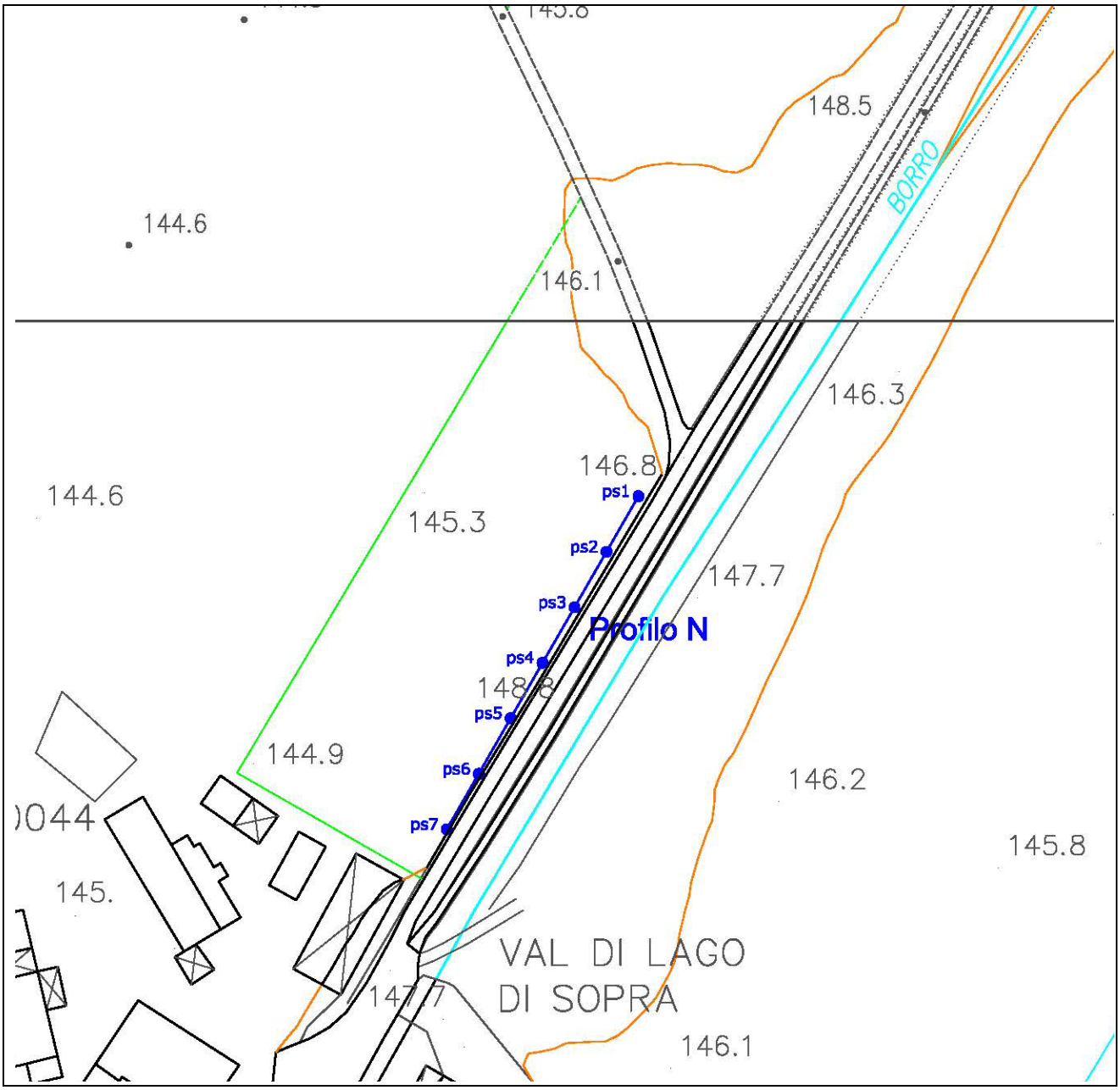
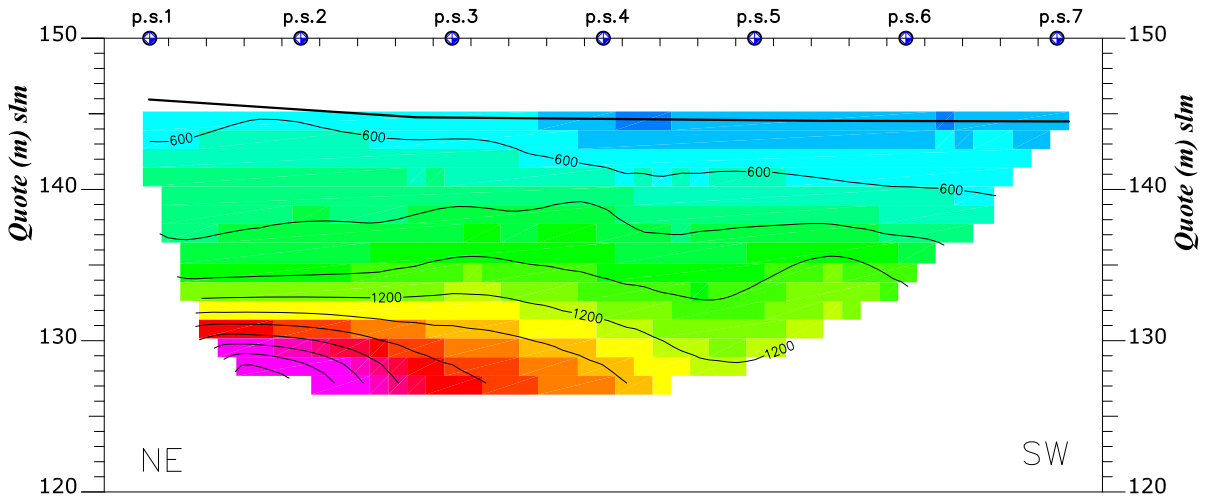


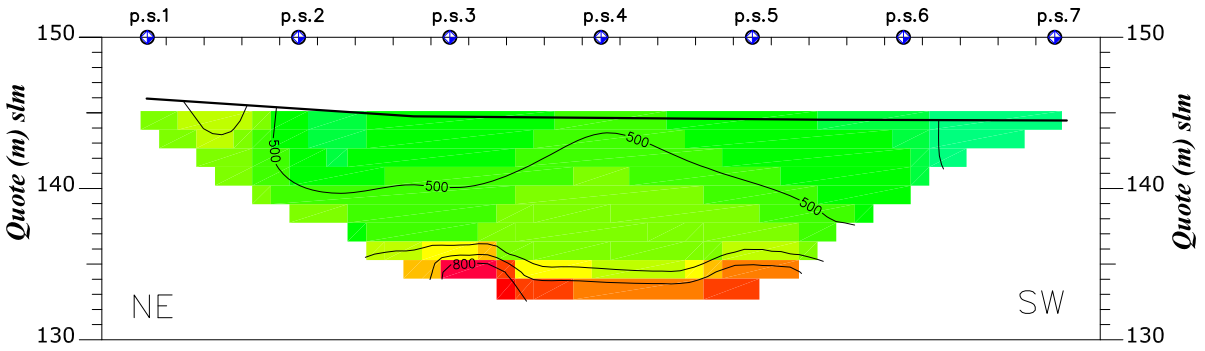
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

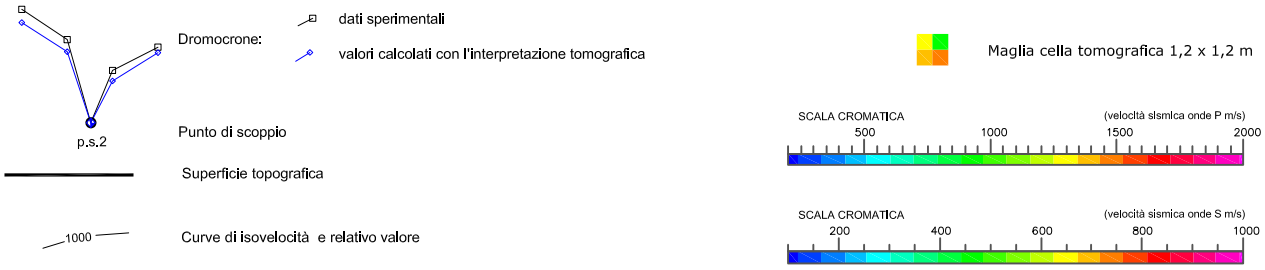
PROFILO SISMICO N onde P



PROFILO SISMICO N onde S



LEGENDA:



Profilo O

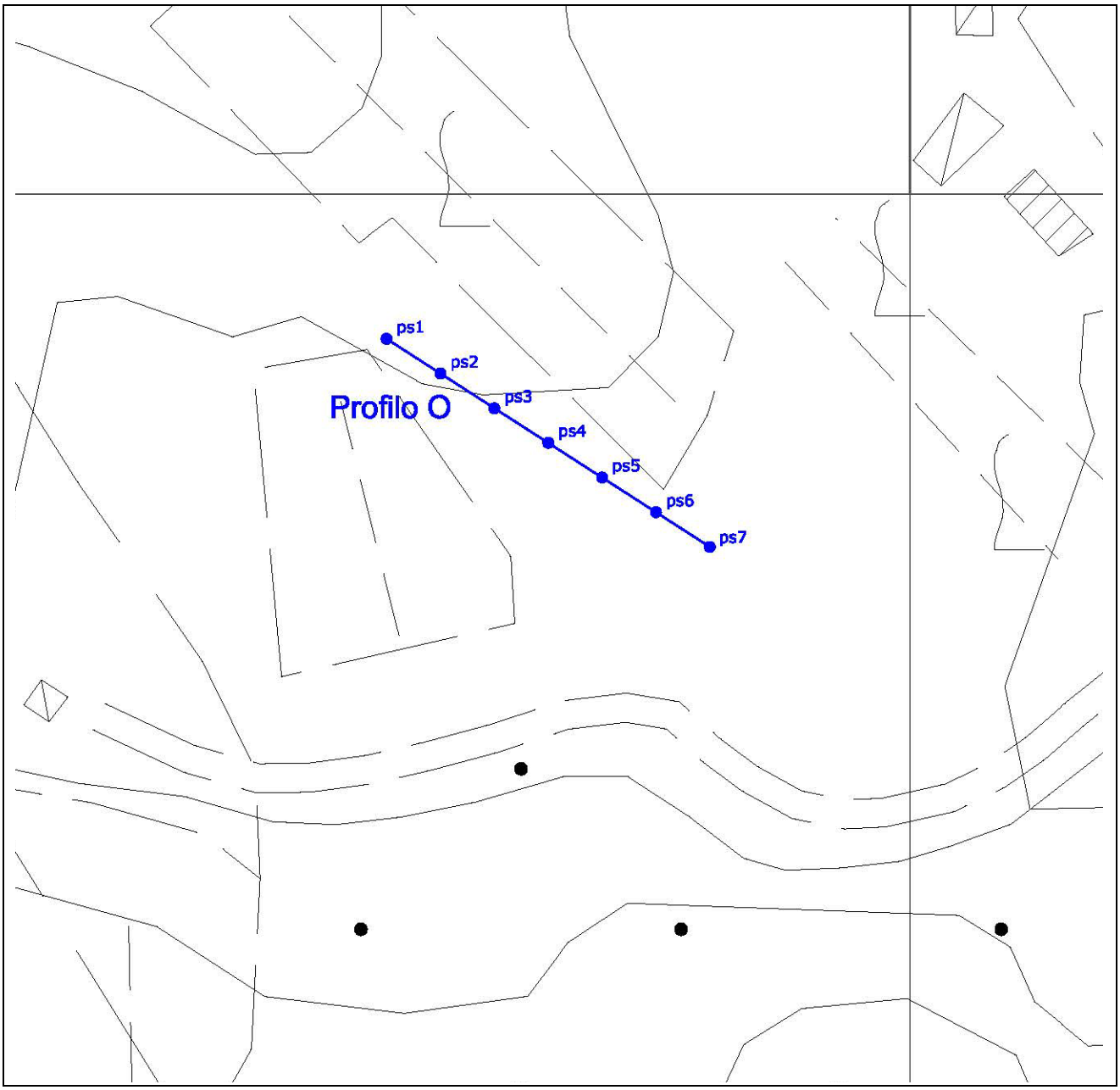
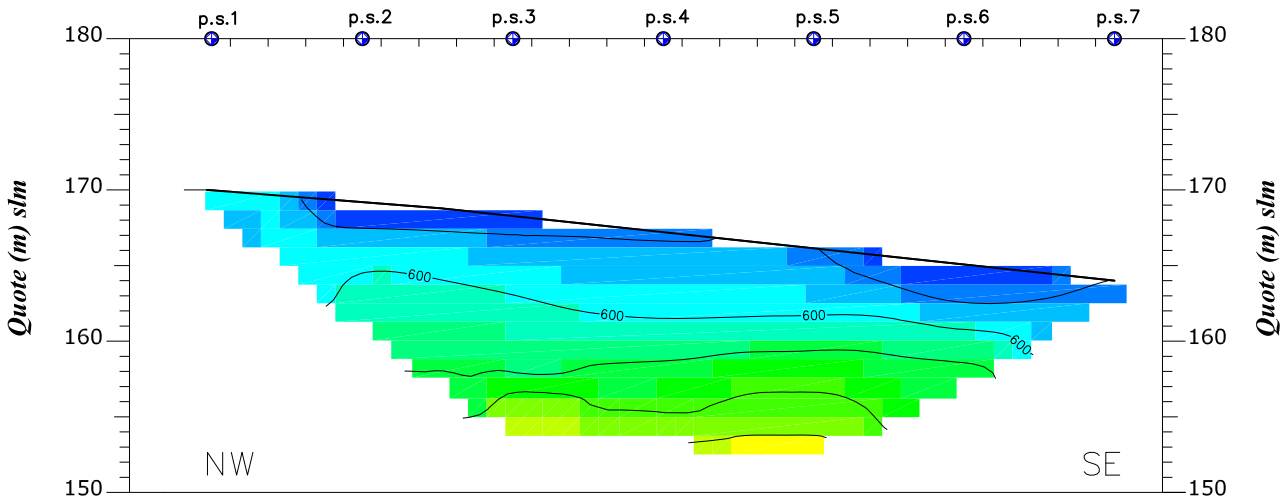


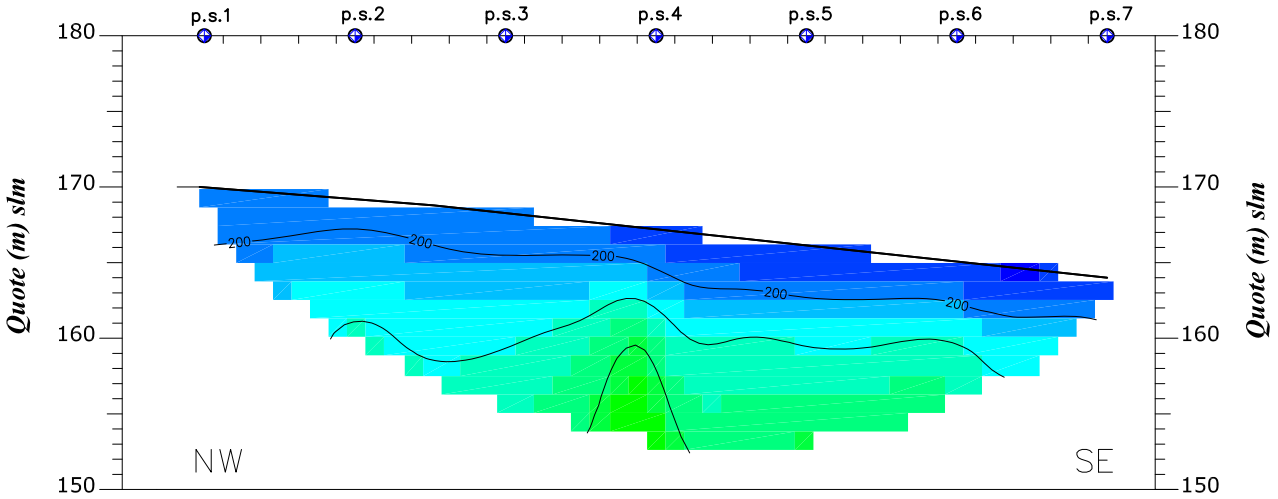
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

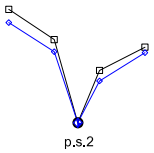
PROFILO SISMICO O onde P



PROFILO SISMICO O onde S



LEGENDA:



Dromocrone:

dati sperimentali

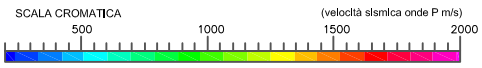
valori calcolati con l'interpretazione tomografica

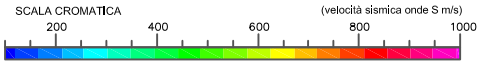
Punto di scoppio

Superficie topografica

1000 Curve di isovelocità e relativo valore

Maglia cella tomografica 1,2 x 1,2 m





Profilo P

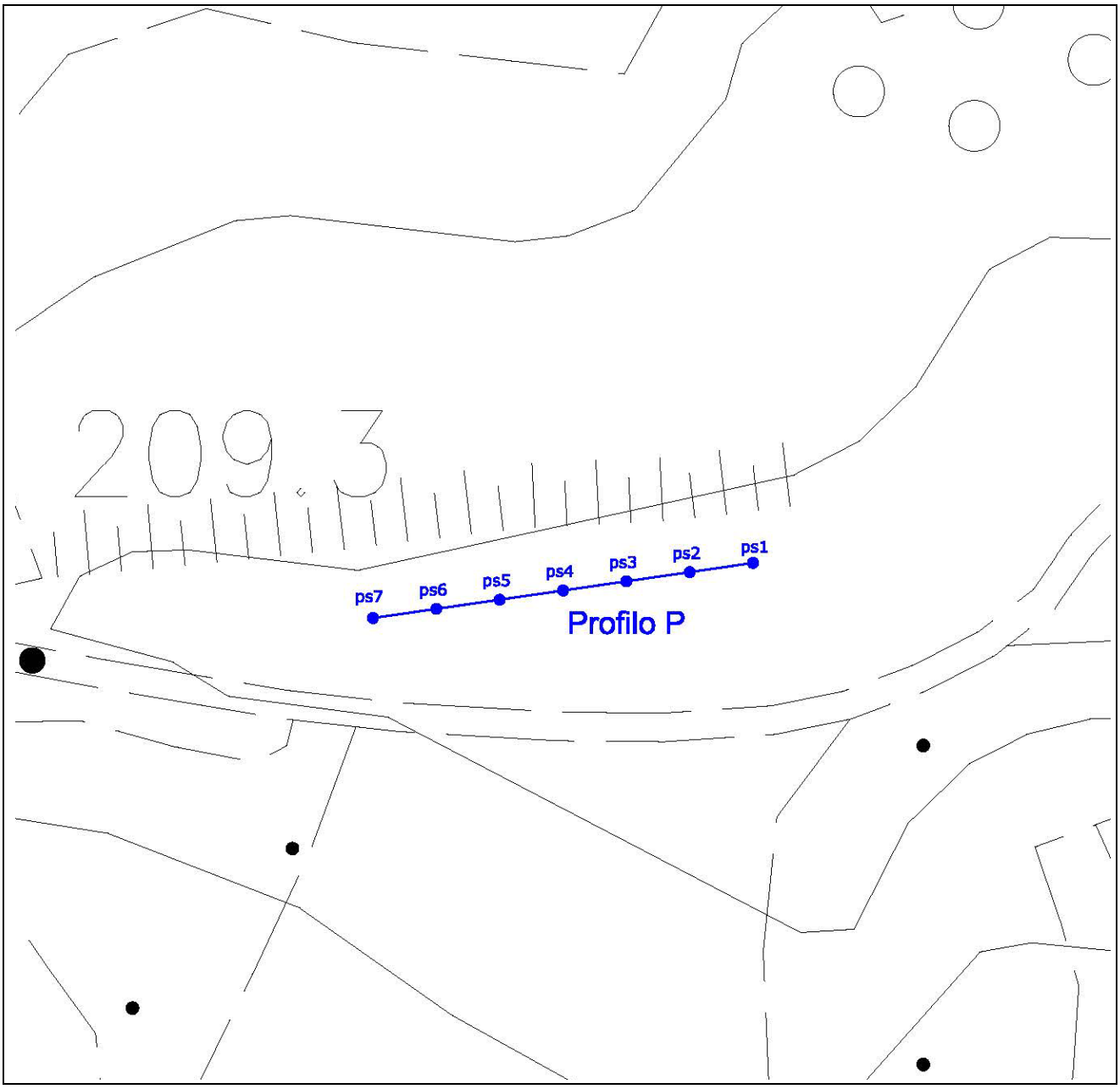
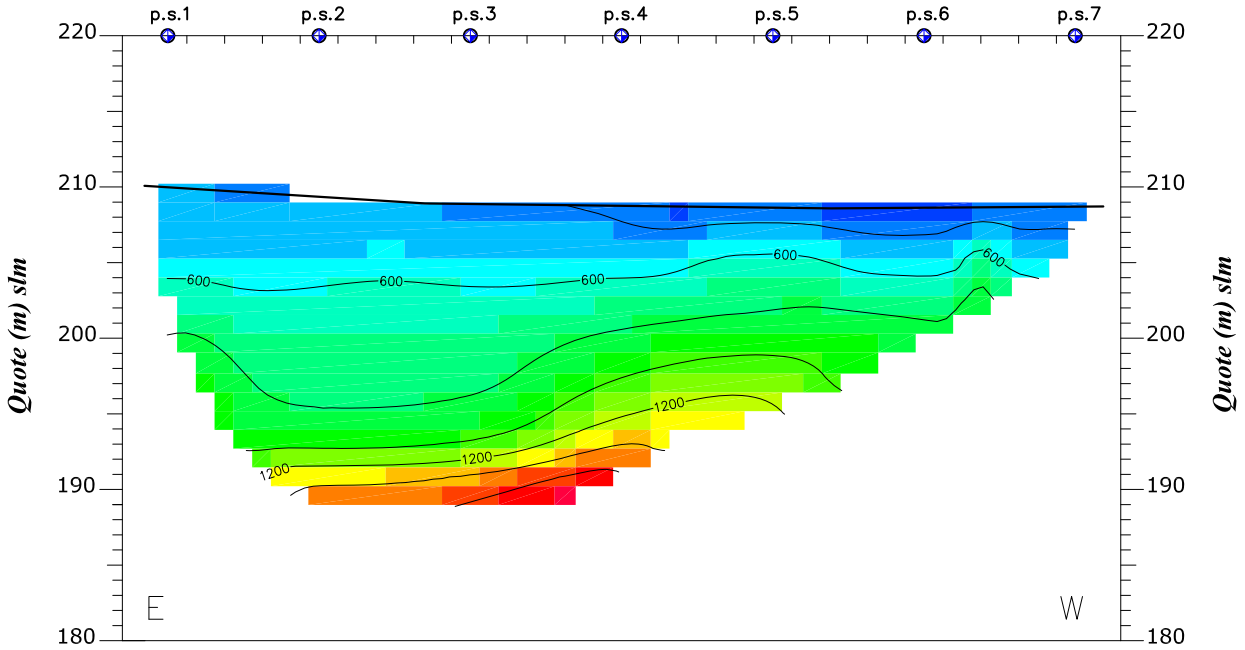


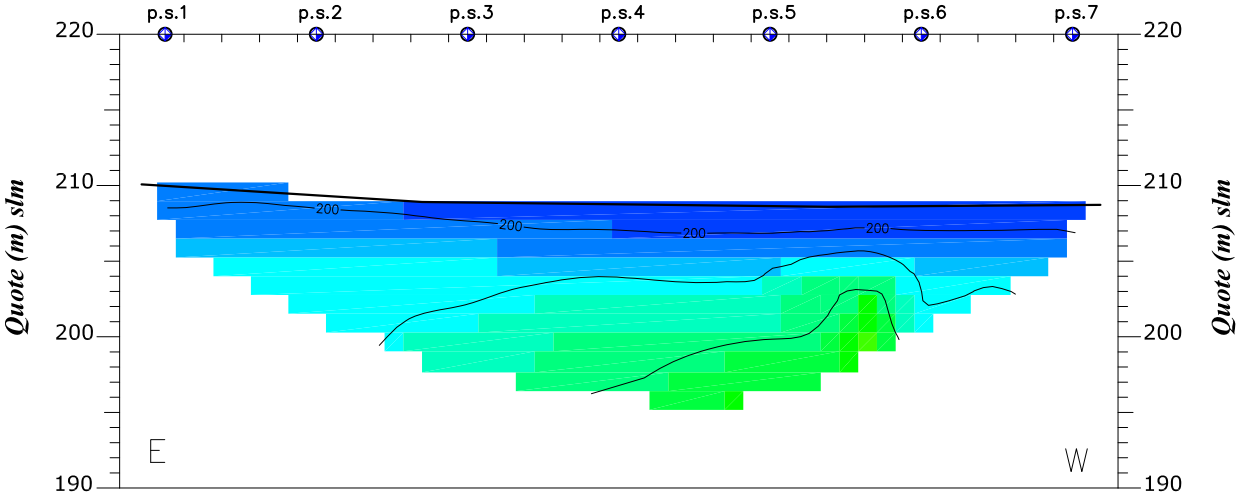
Figura 1.1 – individuazione del sito di studio - scala 1:1.000

Figura 1.2: rilievo sismico

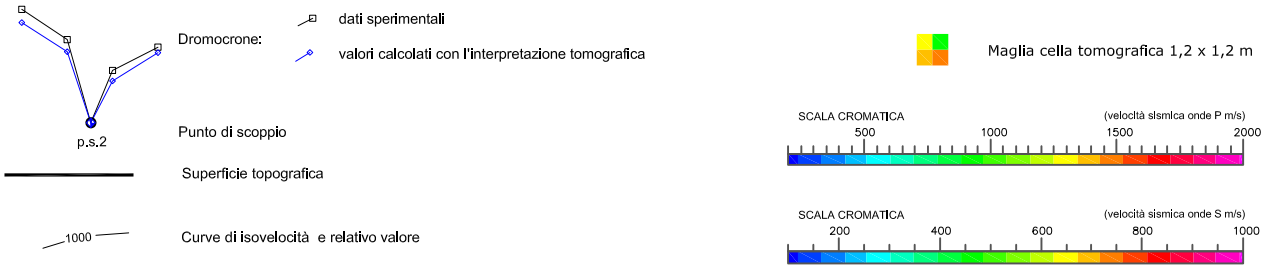
PROFILO SISMICO P onde P



PROFILO SISMICO P onde S

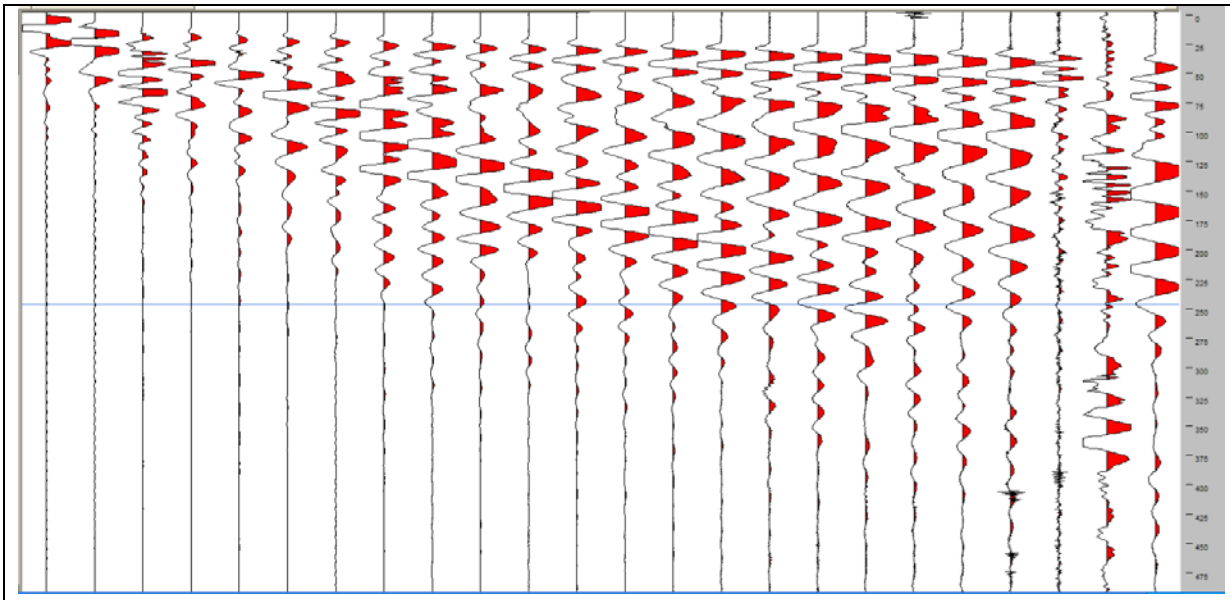


LEGENDA:

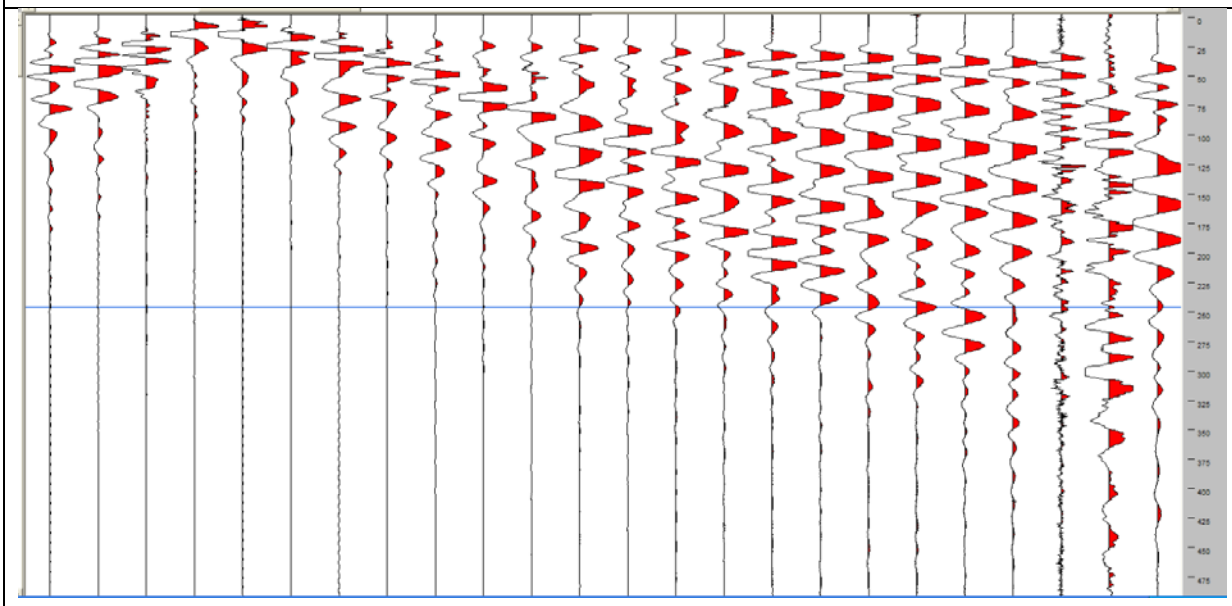


PROFILO SISMICO A

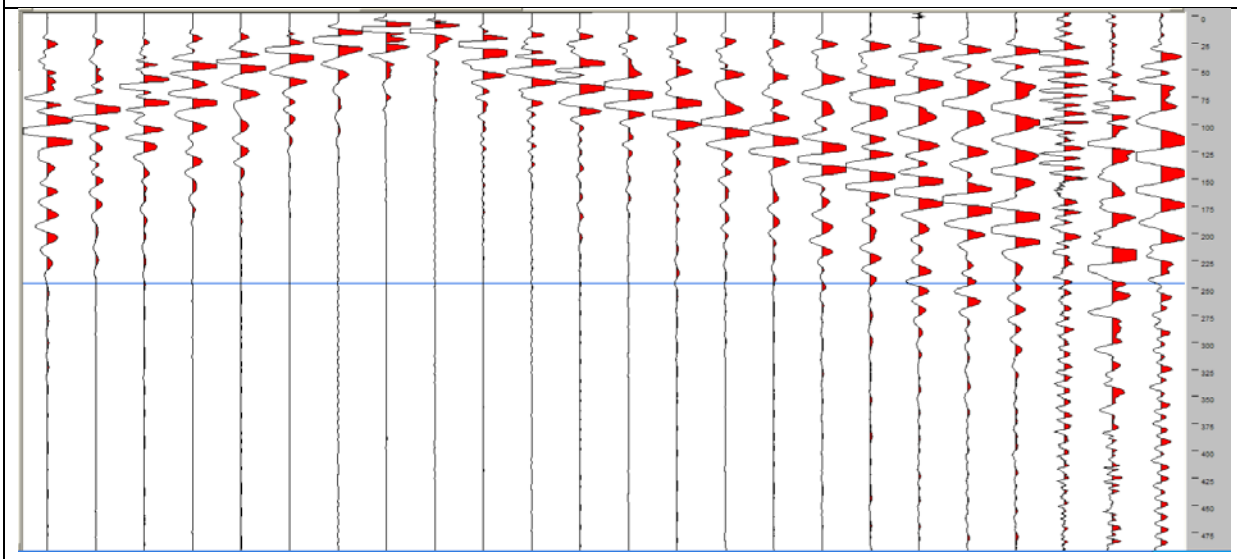
Sismogrammi onde P



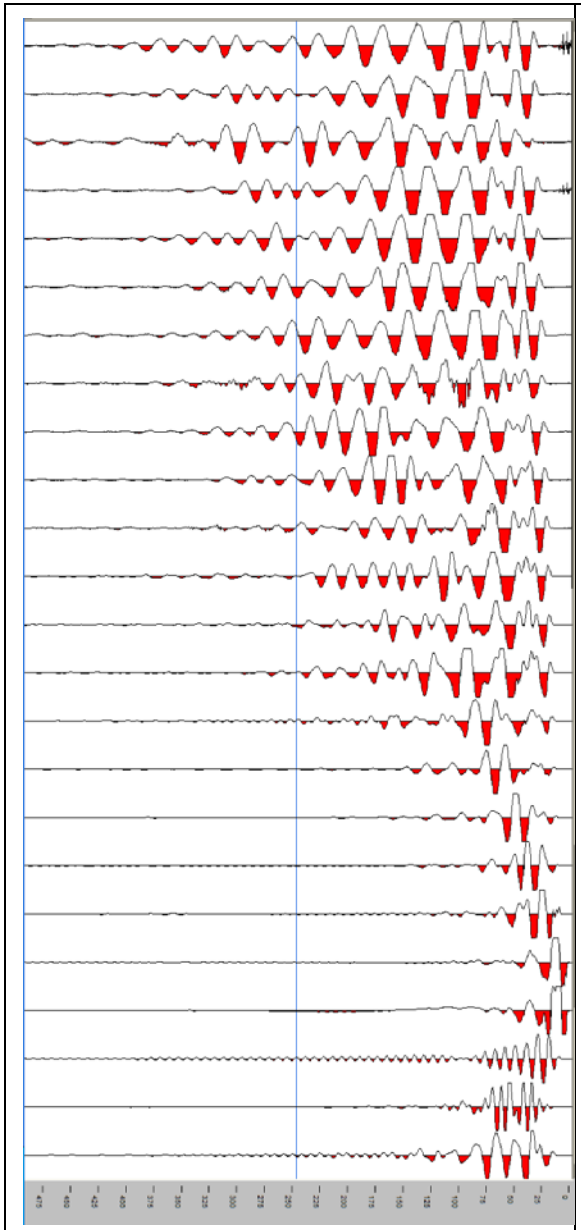
SP1



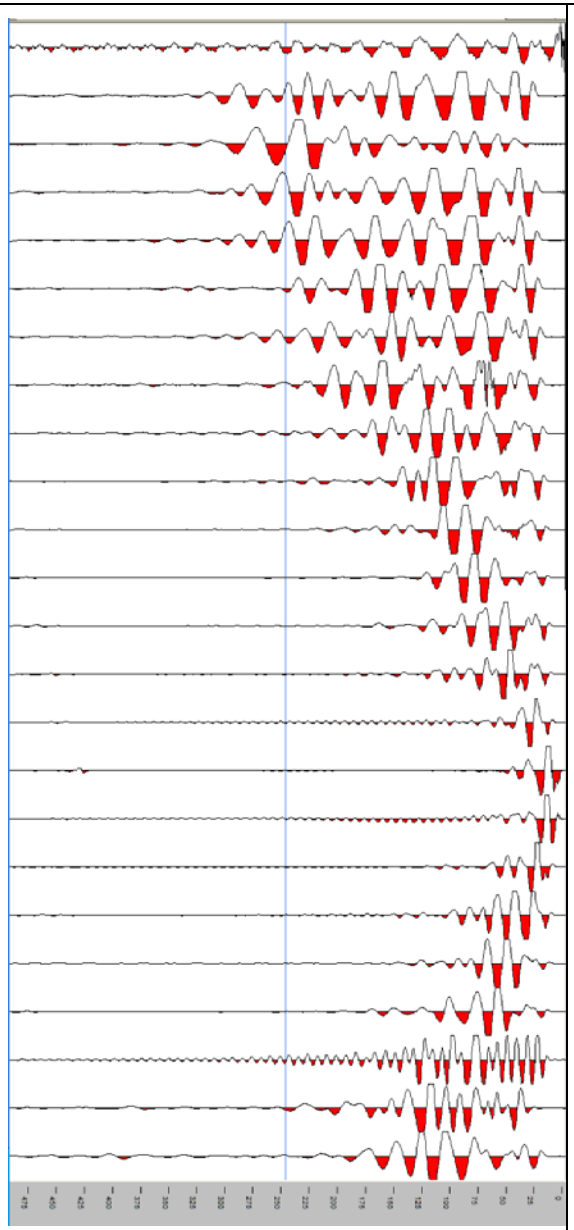
SP2



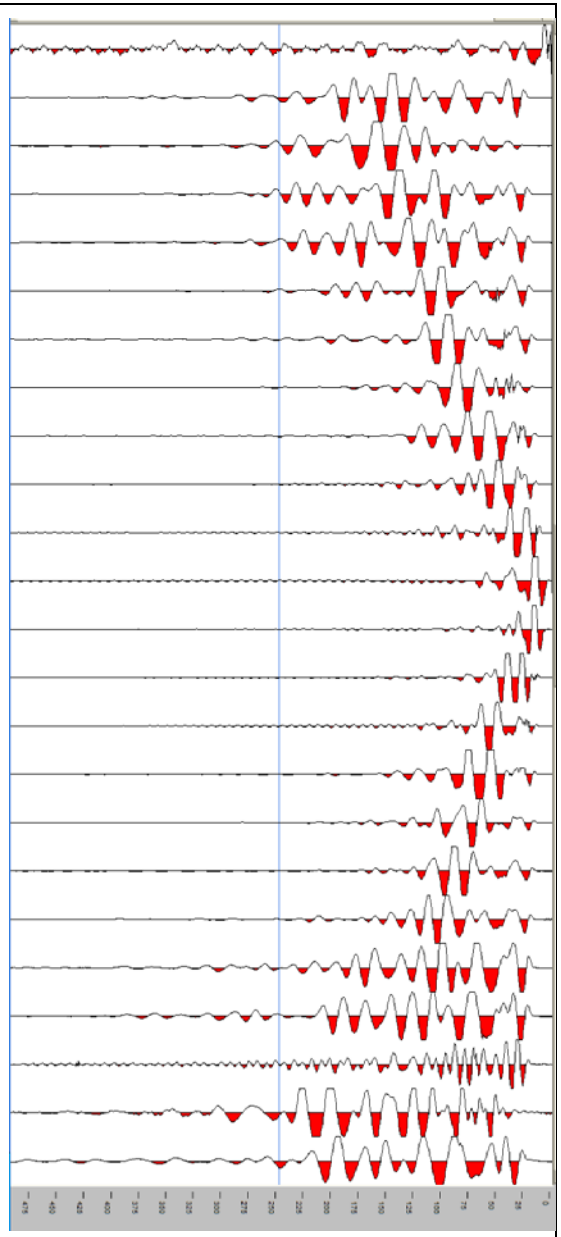
SP3



SP6



SP5



SP4

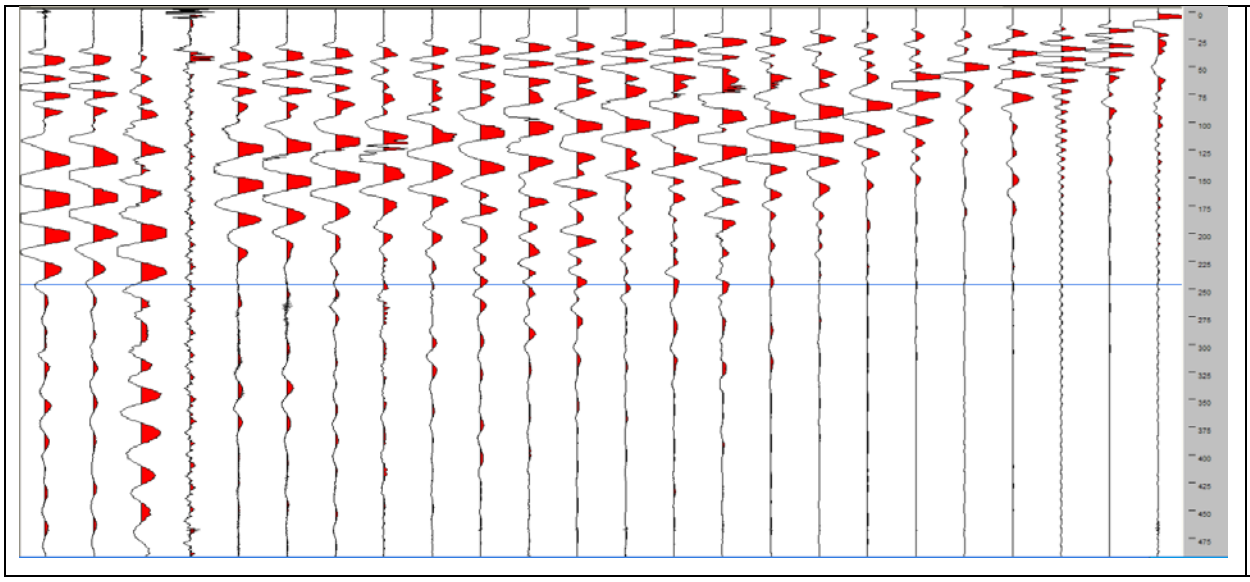
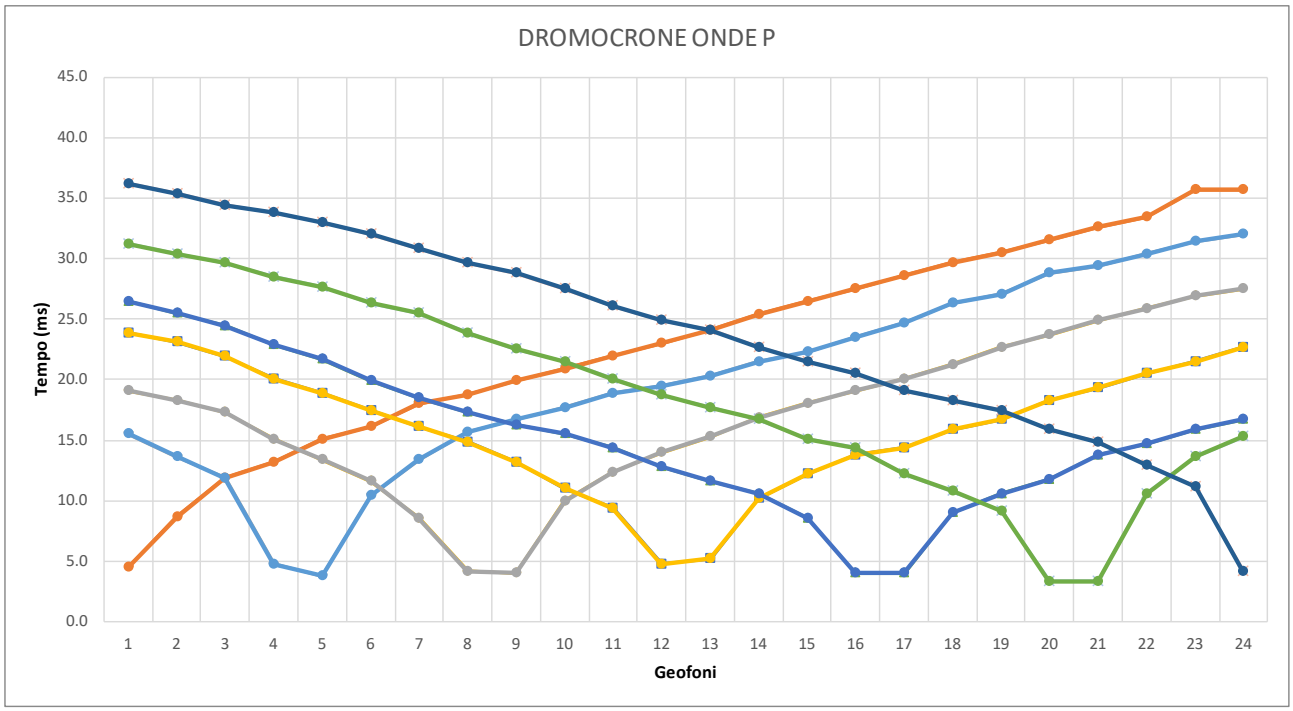
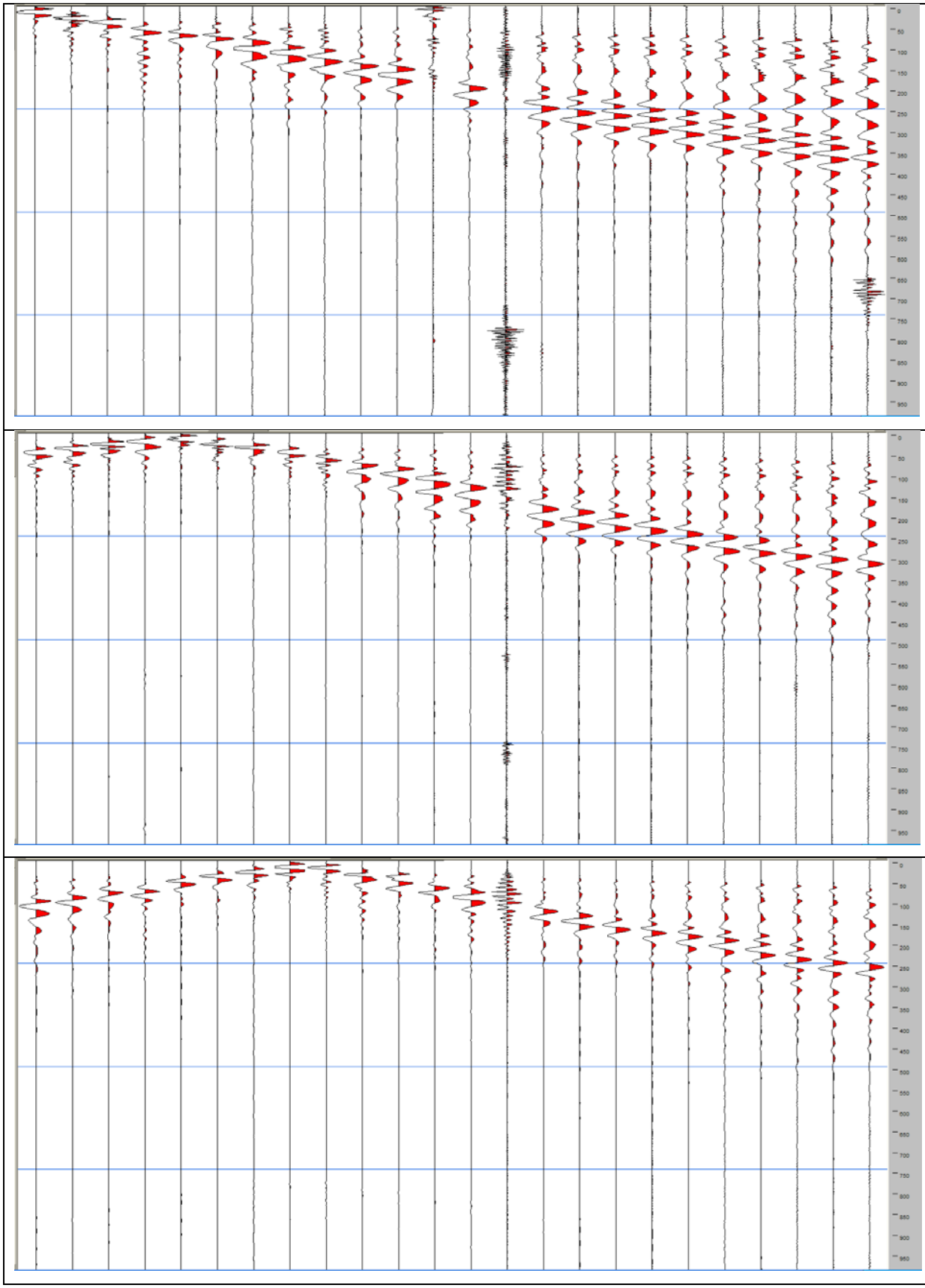


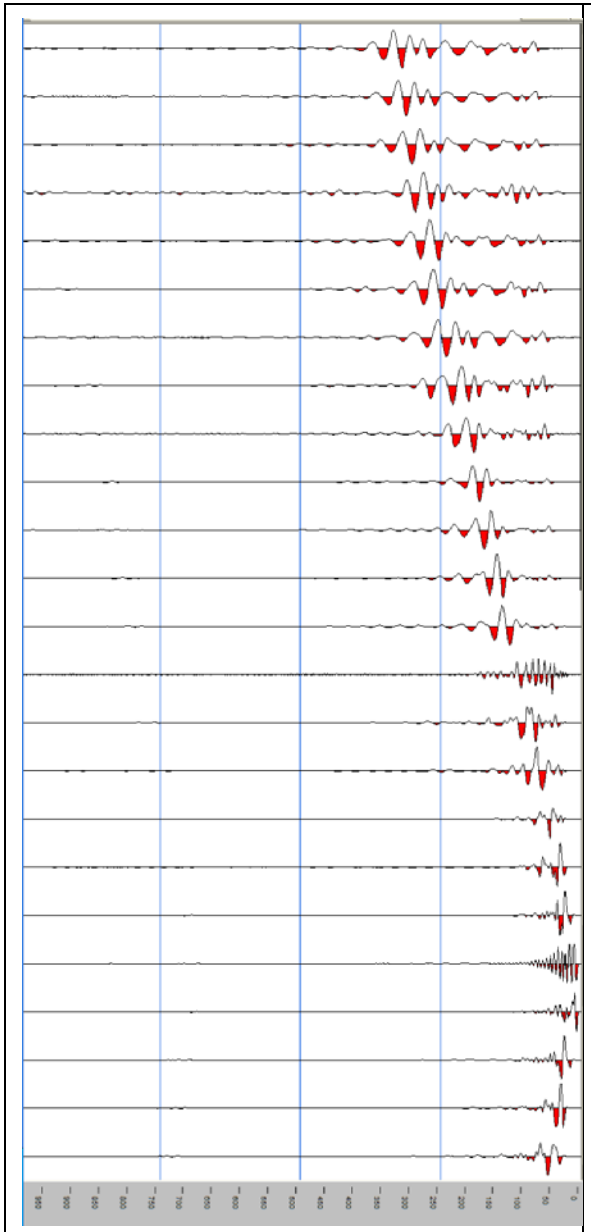
Tabella geometria e tempi onde P

		ONDE P			GEOFONI																							
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
					2.5	4.99	7.49	9.99	12.49	14.98	17.48	19.98	22.47	24.97	27.47	29.96	32.46	34.96	37.46	39.95	42.45	44.95	47.44	49.94	52.44	54.93	57.43	59.93	Progressiva (m)
					266.88	266.76	266.64	266.52	266.4	266.28	266.16	266.05	265.92	265.8	265.67	265.55	265.42	265.3	265.17	265.04	264.92	264.79	264.67	264.54	264.42	264.29	264.17	264.04	Quota (m)
Scoppio	S1	Progressiva (m)	1.25	PS1	4.5	8.7	11.9	13.2	15.1	16.1	18.0	18.8	19.9	20.9	22.0	23.0	24.1	25.4	26.5	27.5	28.6	29.7	30.5	31.5	32.6	33.4	35.7	35.7	Tempo (ms)
		Quota (m)	266.94																										
	S2	Progressiva (m)	11.24	PS2	15.5	13.6	11.9	4.8	3.8	10.4	13.4	15.7	16.7	17.7	18.9	19.5	20.3	21.5	22.3	23.5	24.7	26.3	27.1	28.8	29.4	30.4	31.4	32.0	
		Quota (m)	266.46																										
	S3	Progressiva (m)	21.23	PS3	19.1	18.3	17.3	15.1	13.4	11.6	8.6	4.2	4.0	10.0	12.4	14.0	15.3	16.9	18.1	19.1	20.1	21.3	22.7	23.7	24.9	25.9	26.9	27.5	
		Quota (m)	265.99																										
	S4	Progressiva (m)	31.21	PS4	23.9	23.1	21.9	20.1	18.9	17.5	16.1	14.9	13.2	11.0	9.4	4.8	5.2	10.2	12.2	13.8	14.4	15.9	16.7	18.3	19.3	20.5	21.5	22.7	
		Quota (m)	265.48																										
	S5	Progressiva (m)	41.2	PS5	26.5	25.5	24.5	22.9	21.7	19.9	18.5	17.3	16.3	15.5	14.4	12.8	11.6	10.6	8.6	4.0	4.0	9.0	10.6	11.8	13.8	14.7	15.9	16.7	
		Quota (m)	264.98																										
	S6	Progressiva (m)	51.19	PS6	31.2	30.4	29.6	28.5	27.7	26.3	25.5	23.9	22.5	21.5	20.1	18.7	17.7	16.7	15.1	14.4	12.2	10.8	9.2	3.4	3.4	10.6	13.6	15.3	
		Quota (m)	264.48																										
	S7	Progressiva (m)	61.17	PS7	36.2	35.4	34.4	33.8	33.0	32.0	30.8	29.6	28.8	27.5	26.1	24.9	24.1	22.7	21.5	20.5	19.1	18.3	17.5	15.9	14.9	13.0	11.2	4.2	
		Quota (m)	263.96																										

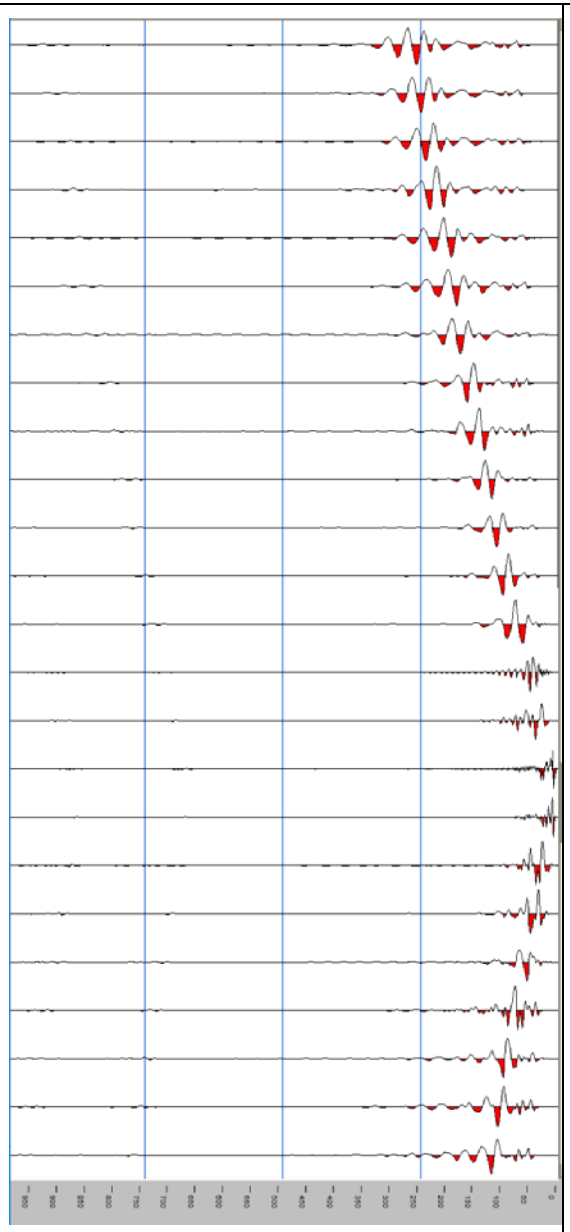


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

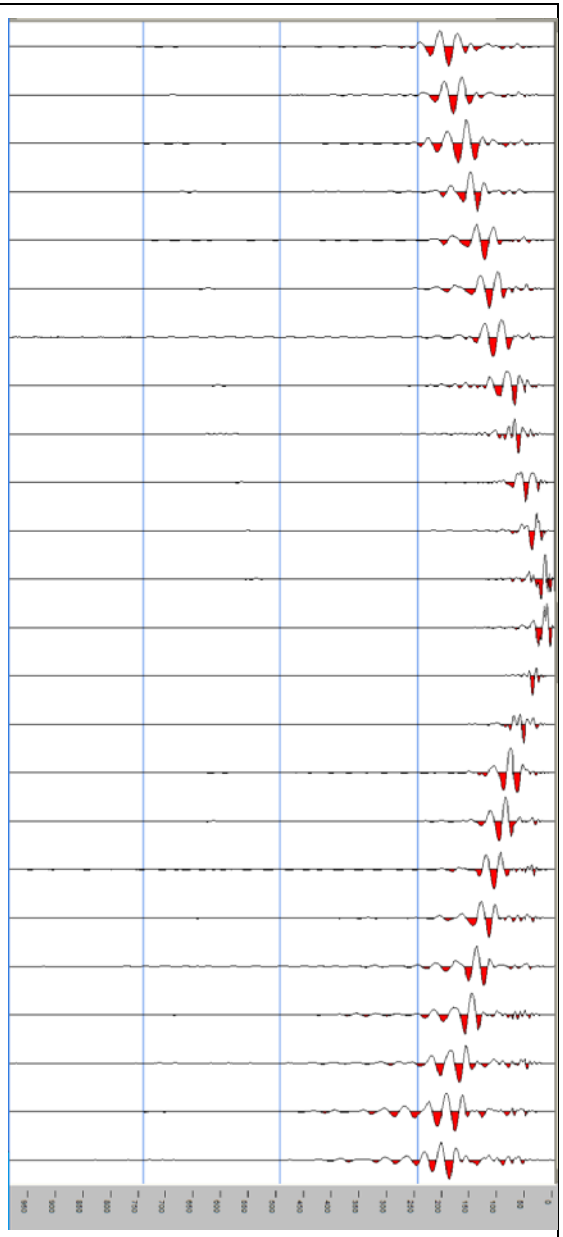




SP6



SP5



SP4

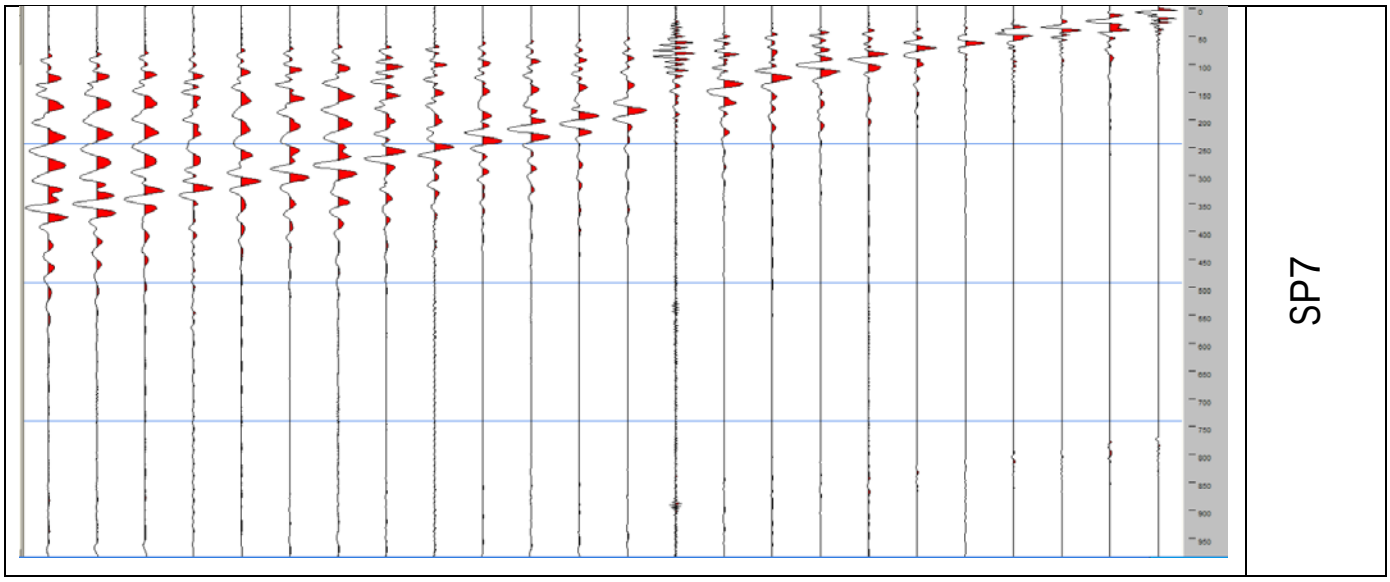
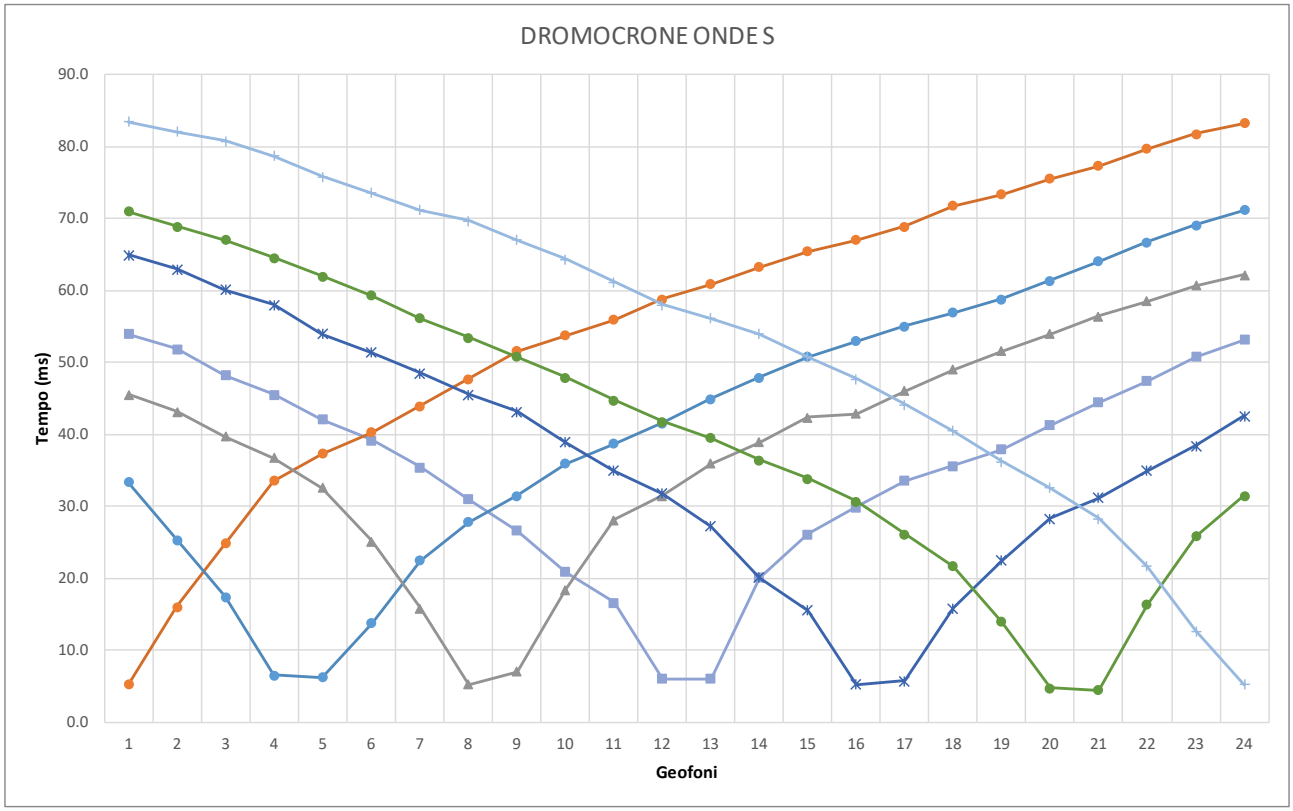


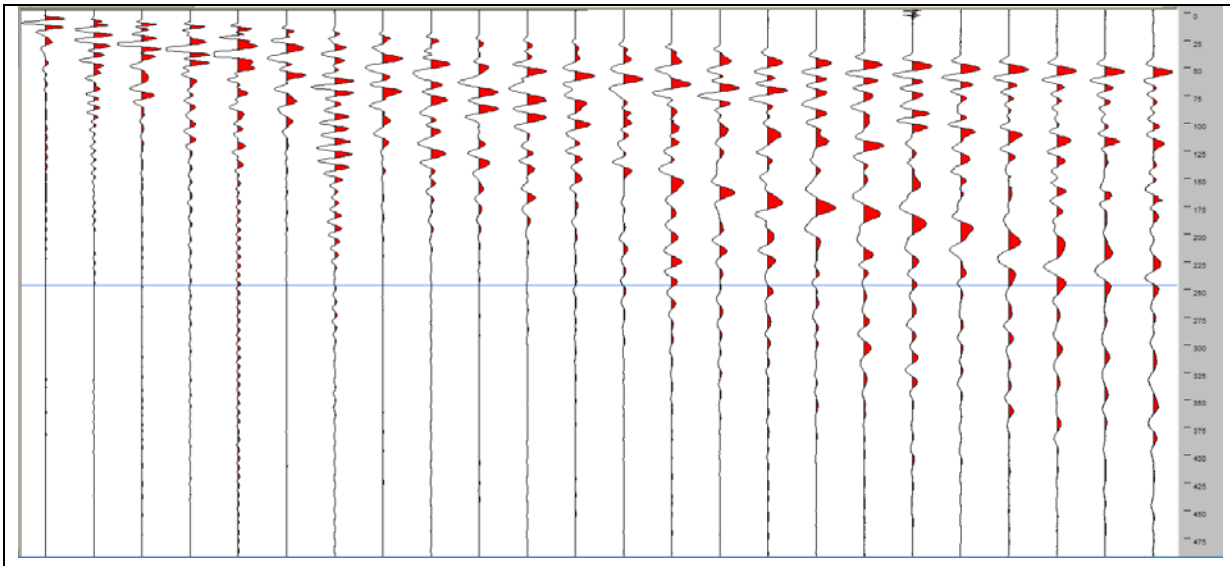
Tabella geometria e tempi onde S

		ONDE S			GEOFONI																							
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
					2.5	4.99	7.49	9.99	12.49	14.98	17.48	19.98	22.47	24.97	27.47	29.96	32.46	34.96	37.46	39.95	42.45	44.95	47.44	49.94	52.44	54.93	57.43	59.93	Progressiva (m)
					266.88	266.76	266.64	266.52	266.4	266.28	266.16	266.05	265.92	265.8	265.67	265.55	265.42	265.3	265.17	265.04	264.92	264.79	264.67	264.54	264.42	264.29	264.17	264.04	Quota (m)
Scoppio	S1	Progressiva (m)	1.25	PS1	5.3	16.1	24.9	33.6	37.3	40.3	44.0	47.7	51.6	53.8	55.9	58.8	60.9	63.3	65.4	67.0	68.9	71.8	73.4	75.5	77.3	79.7	81.8	83.2	Tempo (ms)
		Quota (m)	266.94																										
	S2	Progressiva (m)	11.24	PS2	33.4	25.4	17.5	6.6	6.3	13.8	22.5	27.8	31.5	36.0	38.7	41.6	45.0	47.9	50.8	53.0	55.1	56.9	58.8	61.4	64.1	66.7	69.1	71.2	
		Quota (m)	266.46																										
	S3	Progressiva (m)	21.23	PS3	45.6	43.2	39.7	36.8	32.6	25.2	15.9	5.3	7.1	18.5	28.1	31.5	36.0	38.9	42.4	42.9	46.1	49.0	51.6	54.0	56.4	58.5	60.7	62.2	
		Quota (m)	265.99																										
	S4	Progressiva (m)	31.21	PS4	54.0	51.9	48.2	45.6	42.1	39.2	35.5	31.0	26.7	20.9	16.7	6.1	6.1	20.1	26.2	29.9	33.6	35.7	37.9	41.3	44.5	47.4	50.8	53.2	
		Quota (m)	265.48																										
	S5	Progressiva (m)	41.2	PS5	64.9	63.0	60.1	58.0	54.0	51.4	48.5	45.6	43.2	38.9	35.0	31.8	27.3	20.1	15.6	5.3	5.8	15.9	22.5	28.3	31.2	35.0	38.4	42.6	
		Quota (m)	264.98																										
	S6	Progressiva (m)	51.19	PS6	71.0	68.9	67.0	64.6	62.0	59.3	56.1	53.5	50.8	47.9	44.8	41.8	39.5	36.5	33.9	30.7	26.2	21.7	14.0	4.8	4.5	16.4	25.9	31.5	
		Quota (m)	264.48																										
	S7	Progressiva (m)	61.17	PS7	83.4	82.1	80.8	78.7	75.8	73.6	71.2	69.7	67.0	64.4	61.2	58.0	56.1	54.0	50.8	47.7	44.2	40.5	36.3	32.6	28.3	21.7	12.7	5.3	
		Quota (m)	263.96																										

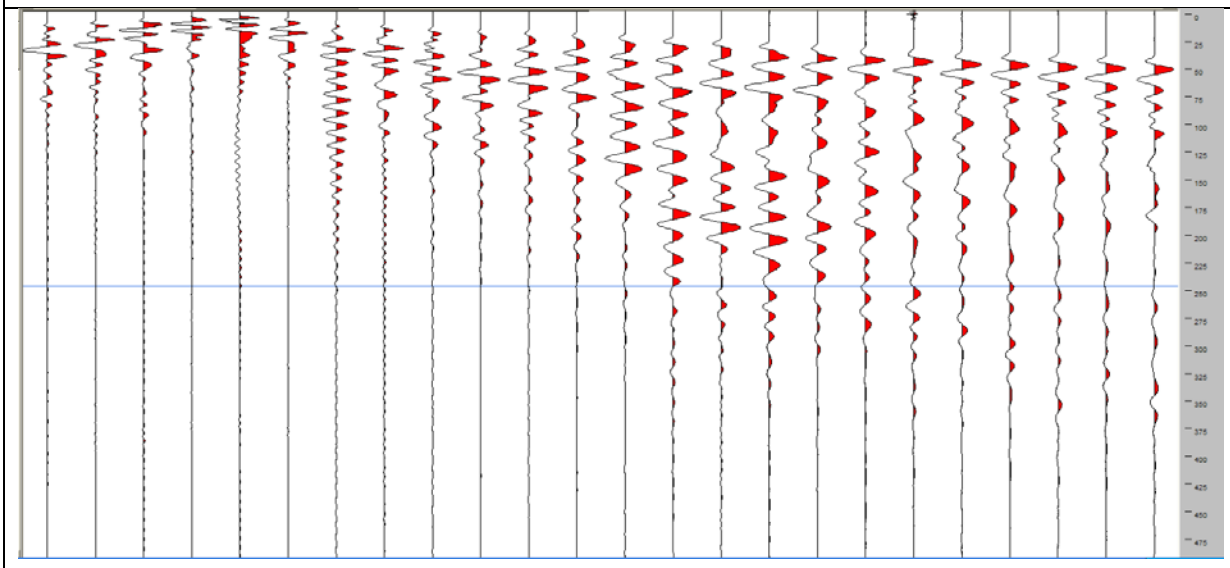


PROFILO SISMICO B

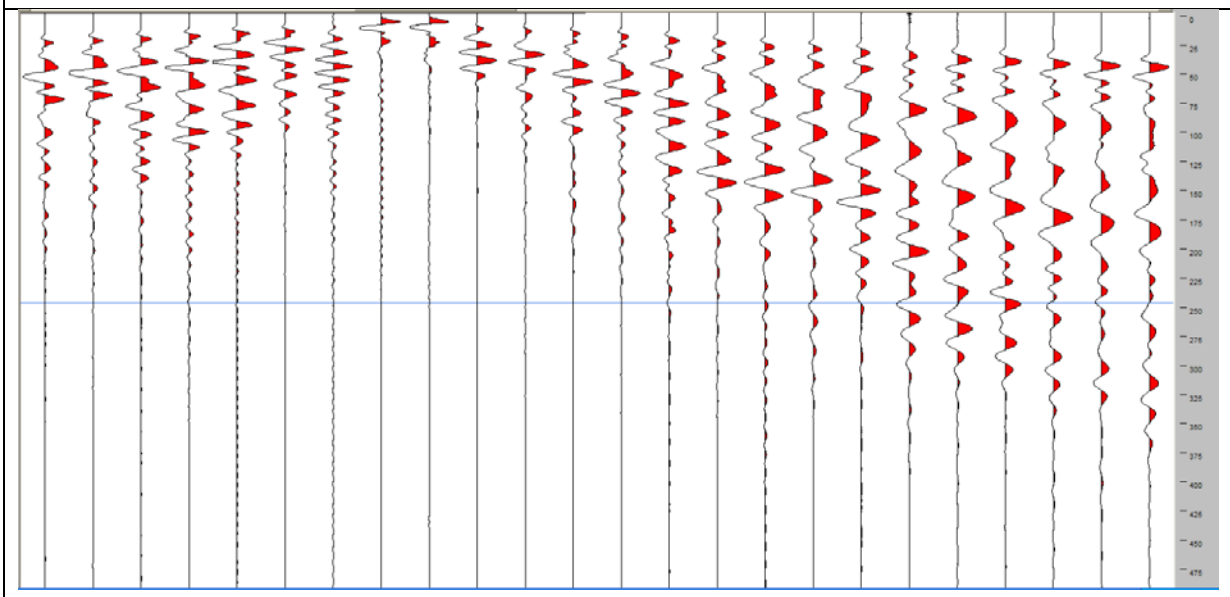
Sismogrammi onde P



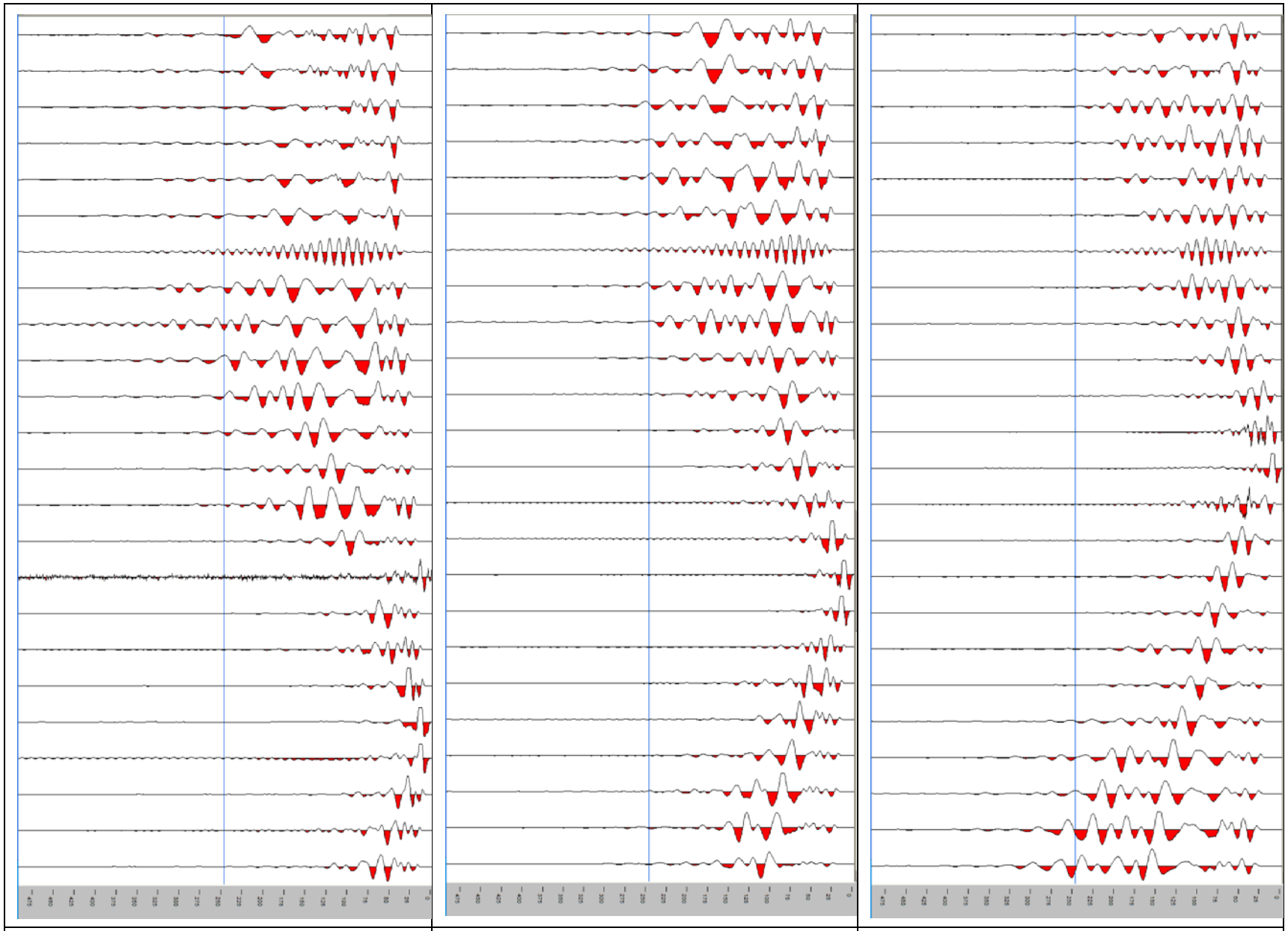
SP1



SP2



SP3



SP6	SP5	SP4

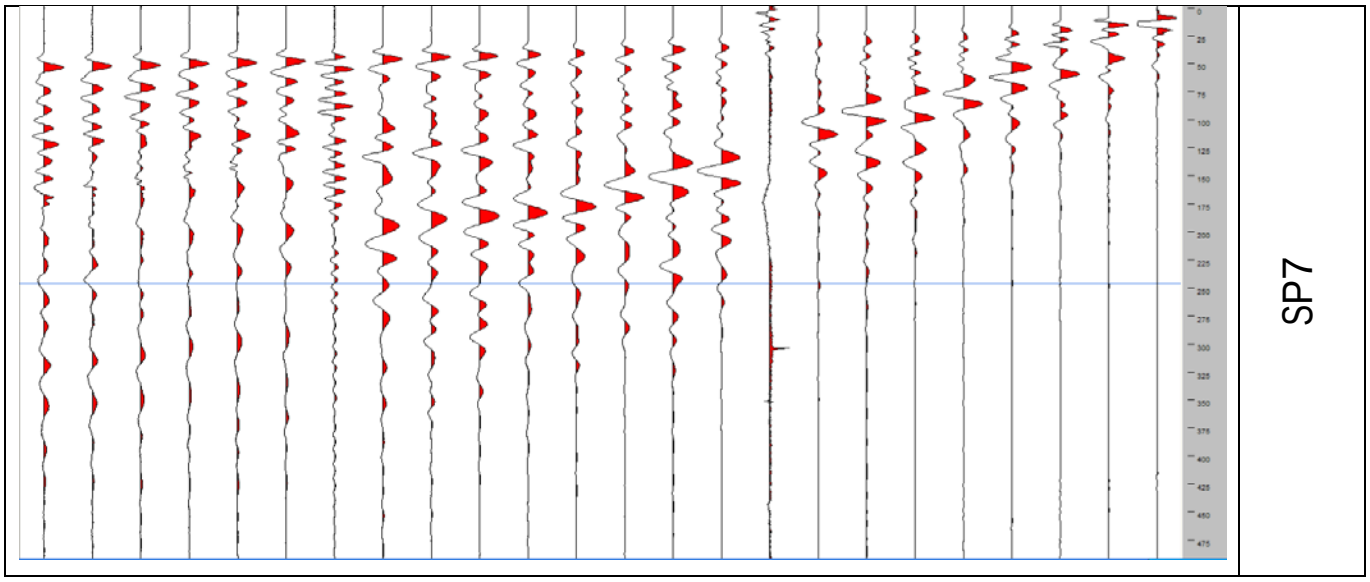
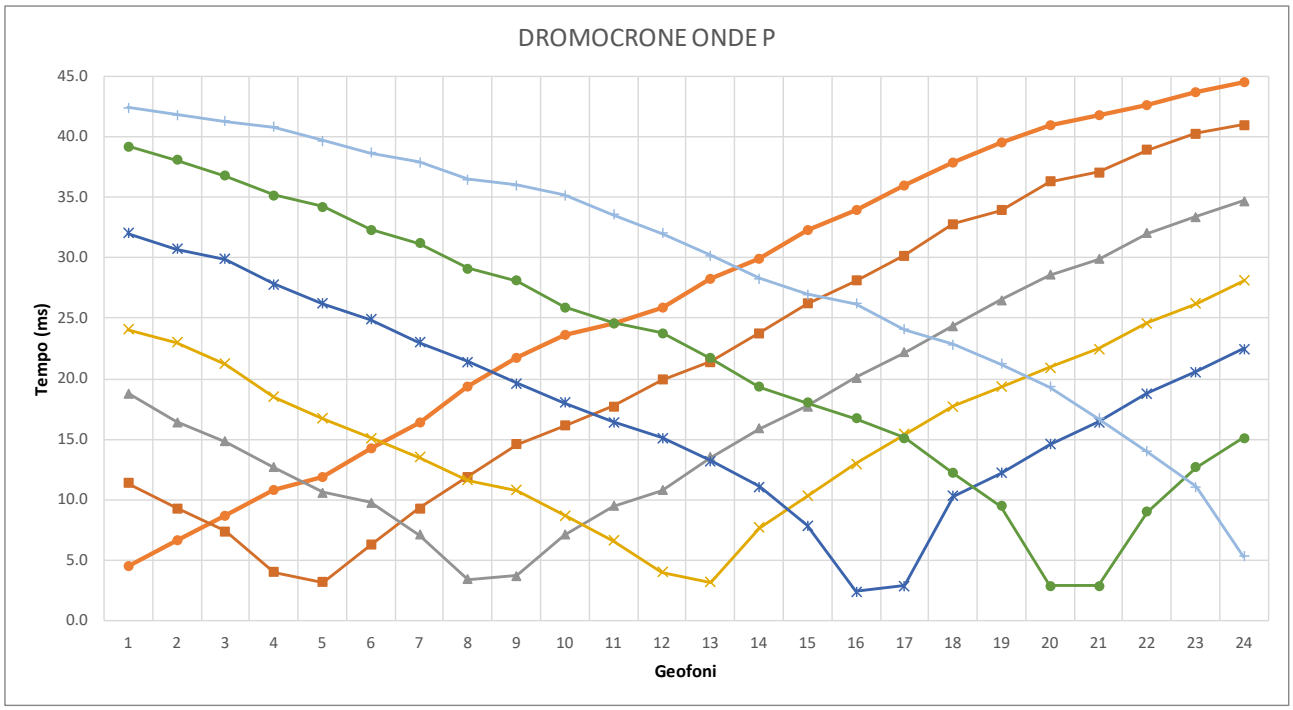
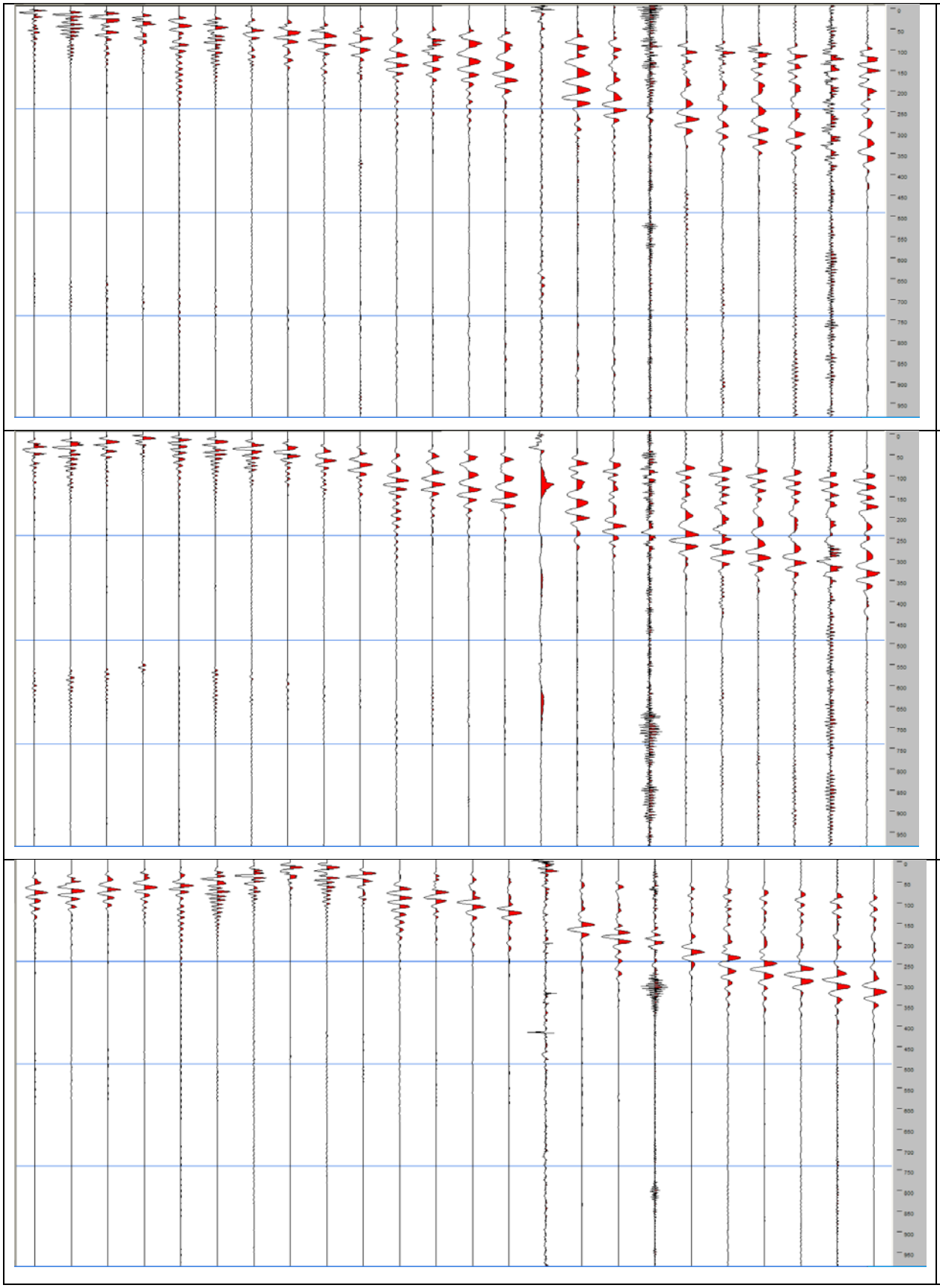


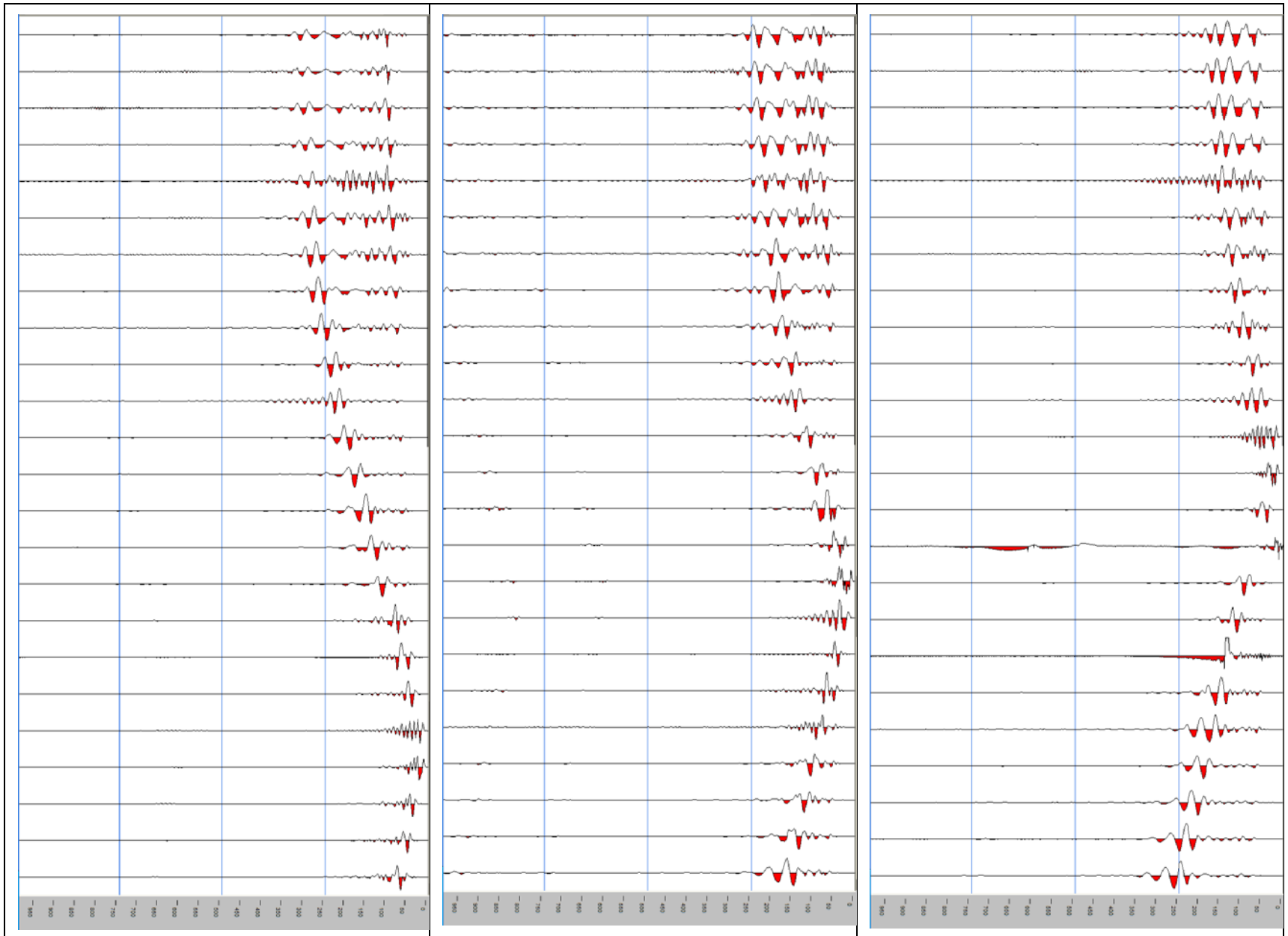
Tabella geometria e tempi onde P

		ONDE P			GEOFONI																							
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
					5	7.49	9.98	12.47	14.96	17.45	19.94	22.43	24.92	27.41	29.91	32.4	34.9	37.39	39.88	42.38	44.87	47.37	49.84	52.36	54.85	57.35	59.83	62.33	Progressiva (m)
					279.54	279.31	279.09	278.86	278.63	278.4	278.17	277.96	277.78	277.61	277.44	277.26	277.09	276.92	276.74	276.57	276.4	276.22	276.05	275.92	275.81	275.7	275.59	275.48	Quota (m)
Scoppio	S1	Progressiva (m)	3.75	PS1	4.5	6.6	8.7	10.8	11.9	14.3	16.4	19.3	21.7	23.6	24.6	25.9	28.3	29.9	32.3	33.9	36.0	37.9	39.5	41.0	41.8	42.6	43.7	44.5	Tempo (ms)
		Quota (m)	279.66																										
	S2	Progressiva (m)	13.69	PS2	11.4	9.3	7.4	4.0	3.2	6.3	9.3	11.9	14.6	16.1	17.7	19.9	21.4	23.8	26.2	28.1	30.2	32.8	33.9	36.3	37.1	38.9	40.3	41.0	
		Quota (m)	278.74																										
	S3	Progressiva (m)	23.65	PS3	18.8	16.4	14.8	12.7	10.6	9.8	7.1	3.4	3.7	7.1	9.5	10.8	13.5	15.9	17.7	20.1	22.2	24.4	26.5	28.6	29.9	32.0	33.4	34.7	
		Quota (m)	277.87																										
	S4	Progressiva (m)	33.63	PS4	24.1	23.0	21.2	18.5	16.7	15.1	13.5	11.6	10.8	8.7	6.6	4.0	3.2	7.7	10.3	13.0	15.4	17.7	19.3	20.9	22.5	24.6	26.2	28.1	
		Quota (m)	277.18																										
	S5	Progressiva (m)	43.61	PS5	32.0	30.7	29.9	27.8	26.2	24.9	23.0	21.4	19.6	18.0	16.4	15.1	13.2	11.1	7.9	2.4	2.9	10.3	12.2	14.6	16.4	18.8	20.6	22.5	
		Quota (m)	276.48																										
	S6	Progressiva (m)	53.59	PS6	39.2	38.1	36.8	35.2	34.2	32.3	31.2	29.1	28.1	25.9	24.6	23.8	21.7	19.3	18.0	16.7	15.1	12.2	9.5	2.9	2.9	9.0	12.7	15.1	
		Quota (m)	275.86																										
	S7	Progressiva (m)	63.56	PS7	42.4	41.8	41.3	40.8	39.7	38.7	37.9	36.5	36.0	35.2	33.6	32.0	30.2	28.3	27.0	26.2	24.1	22.8	21.2	19.3	16.7	14.0	11.1	5.3	
		Quota (m)	275.43																										



Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)





SP6	SP5	SP4

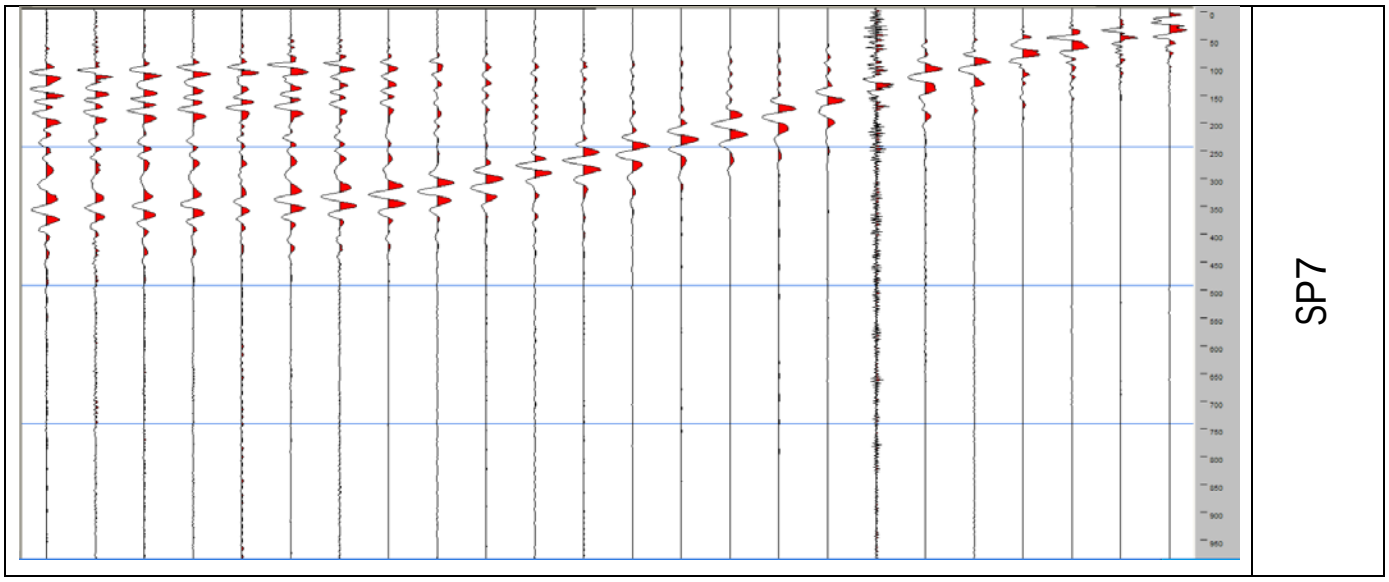
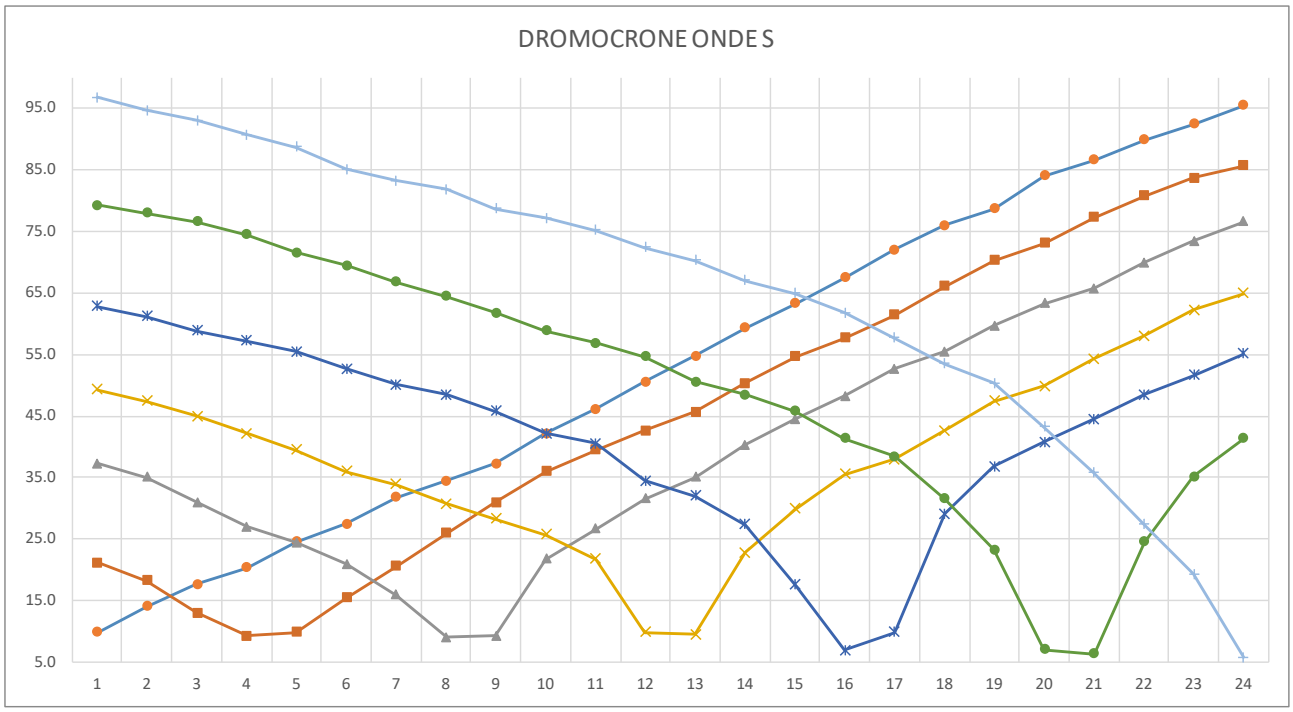


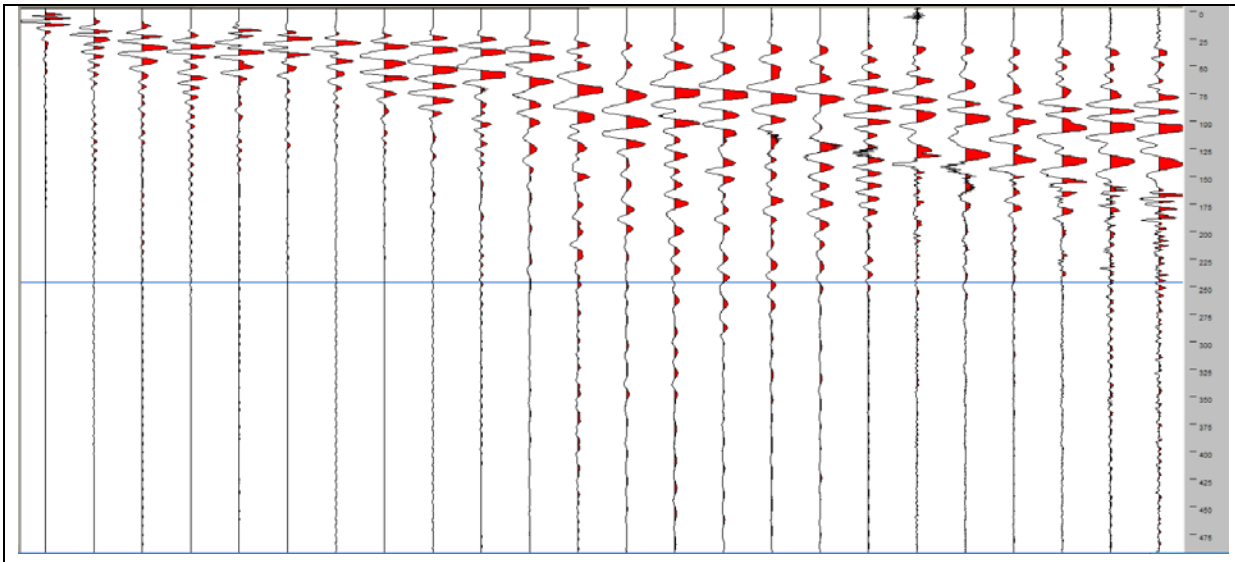
Tabella geometria e tempi onde S

		ONDE S			GEOFONI																							
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
					5	7.49	9.98	12.47	14.96	17.45	19.94	22.43	24.92	27.41	29.91	32.4	34.9	37.39	39.88	42.38	44.87	47.37	49.84	52.36	54.85	57.35	59.83	62.33	Progressiva (m)
					279.54	279.31	279.09	278.86	278.63	278.4	278.17	277.96	277.78	277.61	277.44	277.26	277.09	276.92	276.74	276.57	276.4	276.22	276.05	275.92	275.81	275.7	275.59	275.48	Quota (m)
Scoppio	S1	Progressiva (m)	3.75	PS1	9.8	14.0	17.7	20.4	24.6	27.5	31.8	34.4	37.3	42.1	46.1	50.6	54.8	59.3	63.3	67.5	72.0	76.0	78.7	84.0	86.6	89.8	92.4	95.4	Tempo (ms)
		Quota (m)	279.66																										
	S2	Progressiva (m)	13.69	PS2	21.2	18.3	13.0	9.3	9.8	15.4	20.6	25.9	31.0	36.0	39.5	42.6	45.6	50.3	54.6	57.7	61.4	66.0	70.2	73.1	77.3	80.8	83.7	85.6	
		Quota (m)	278.74																										
	S3	Progressiva (m)	23.65	PS3	37.3	35.0	31.0	27.0	24.4	20.9	15.9	9.0	9.3	21.7	26.7	31.5	35.0	40.3	44.5	48.2	52.7	55.4	59.6	63.3	65.7	69.9	73.4	76.5	
		Quota (m)	277.87																										
	S4	Progressiva (m)	33.63	PS4	49.3	47.4	45.0	42.1	39.5	36.0	33.9	30.7	28.3	25.7	21.7	9.8	9.5	22.8	29.9	35.5	37.9	42.6	47.4	49.8	54.3	58.0	62.2	64.9	
		Quota (m)	277.18																										
	S5	Progressiva (m)	43.61	PS5	62.8	61.2	58.8	57.2	55.4	52.7	50.1	48.5	45.8	42.1	40.5	34.4	32.0	27.3	17.5	6.9	9.8	29.1	36.8	40.8	44.5	48.5	51.6	55.1	
		Quota (m)	276.48																										
	S6	Progressiva (m)	53.59	PS6	79.2	77.9	76.5	74.4	71.5	69.4	66.7	64.4	61.7	58.8	56.9	54.6	50.6	48.5	45.8	41.3	38.4	31.5	23.3	7.1	6.3	24.6	35.2	41.3	
		Quota (m)	275.86																										
	S7	Progressiva (m)	63.56	PS7	96.7	94.6	93.0	90.6	88.7	85.0	83.2	81.8	78.7	77.1	75.2	72.3	70.2	67.0	64.9	61.7	57.7	53.5	50.3	43.2	35.7	27.3	19.3	5.8	
		Quota (m)	275.43																										

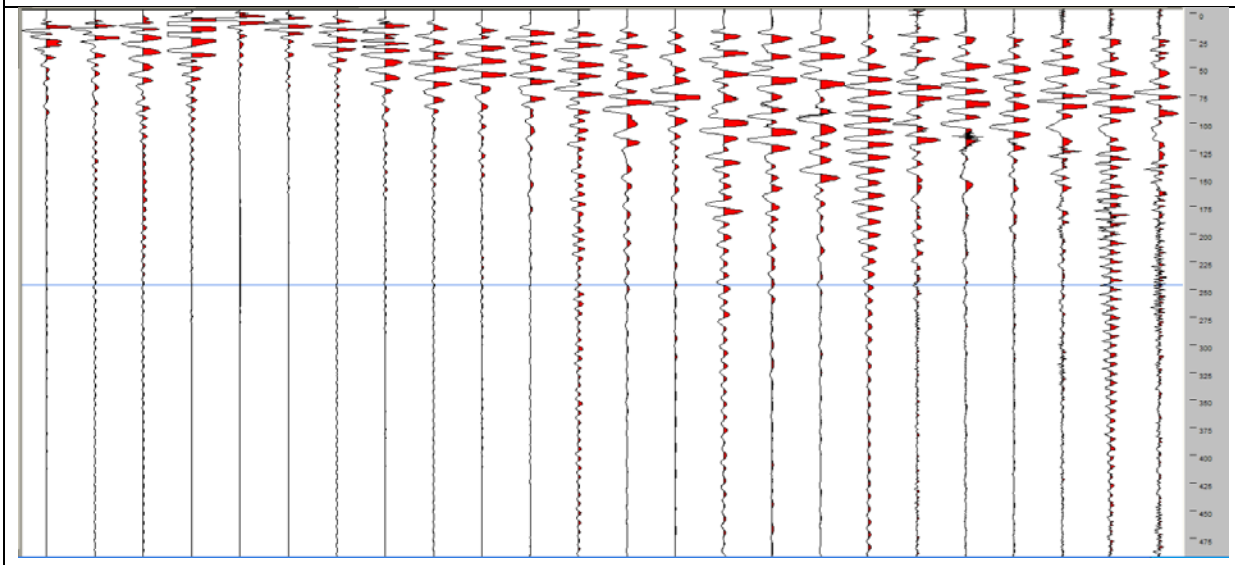


PROFILO SISMICO C

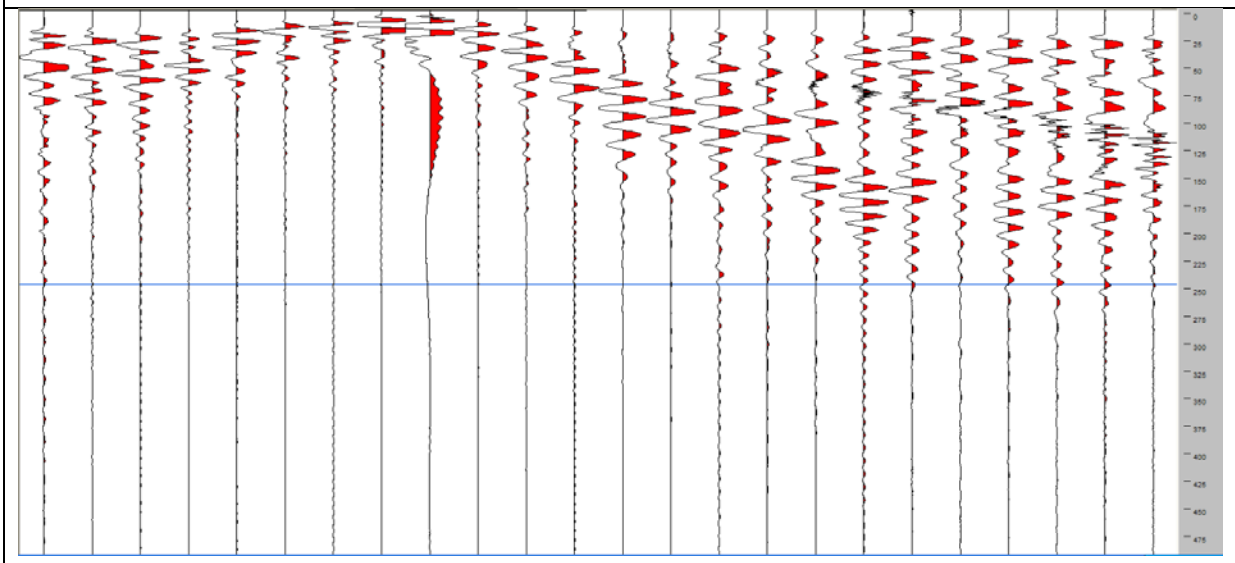
Sismogrammi onde P



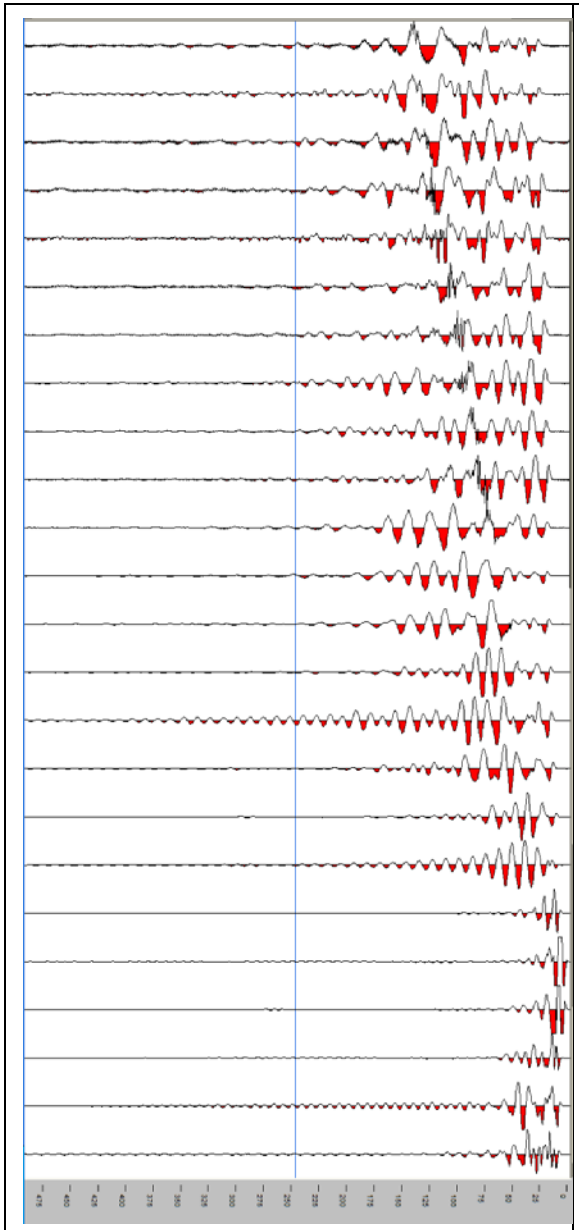
SP1



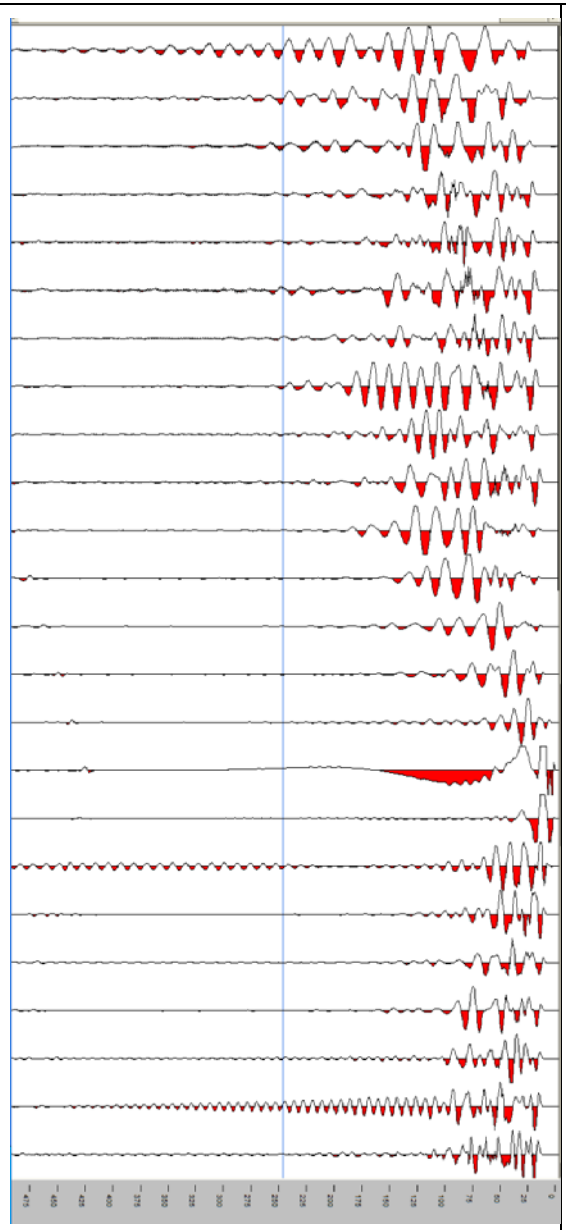
SP2



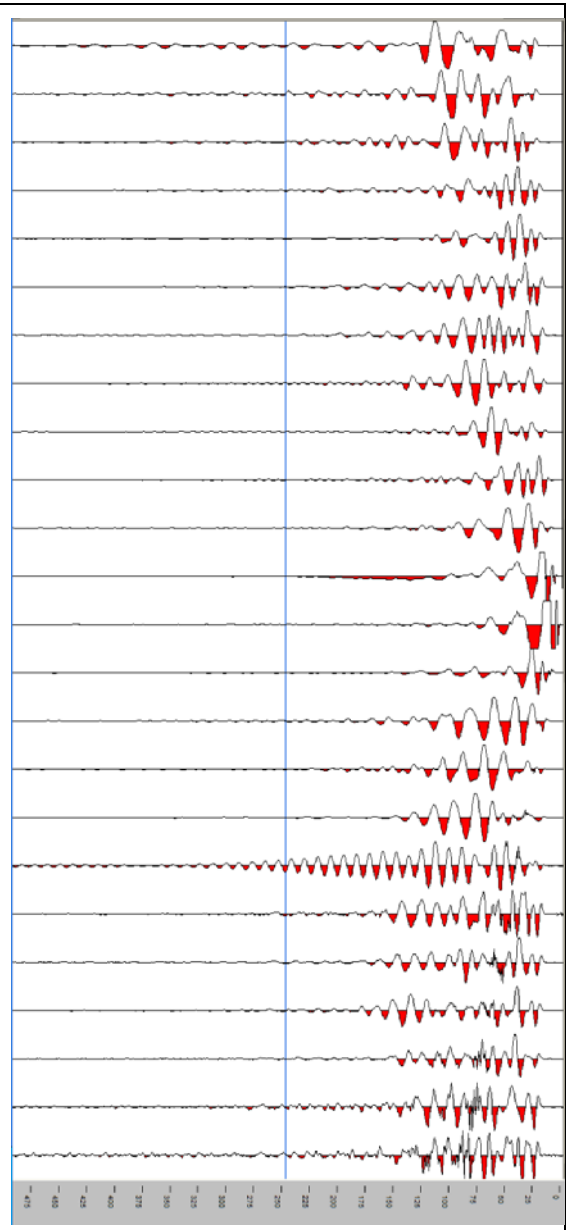
SP3



SP6



SP5



SP4

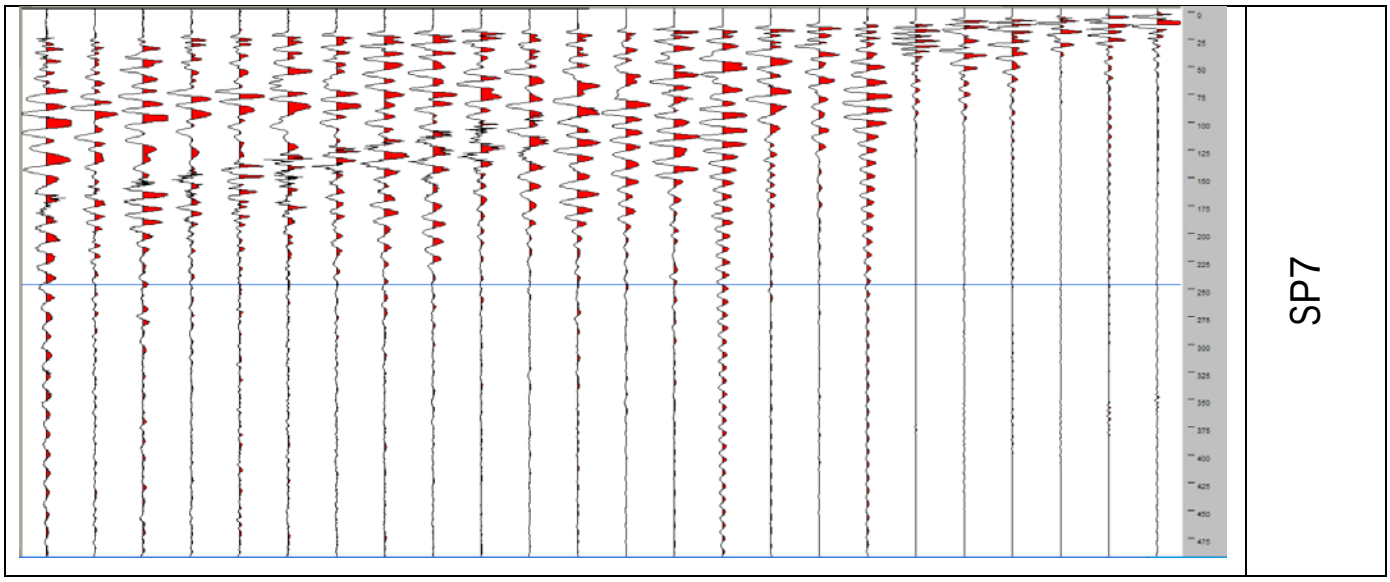
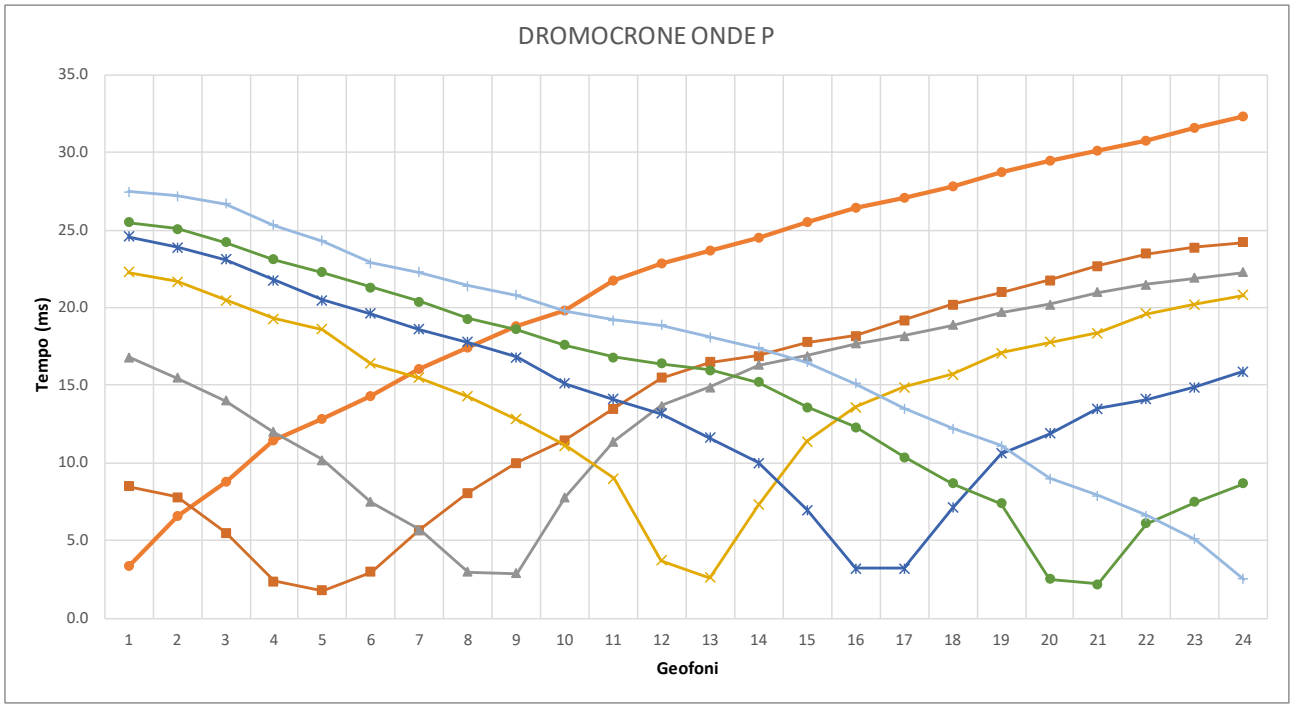
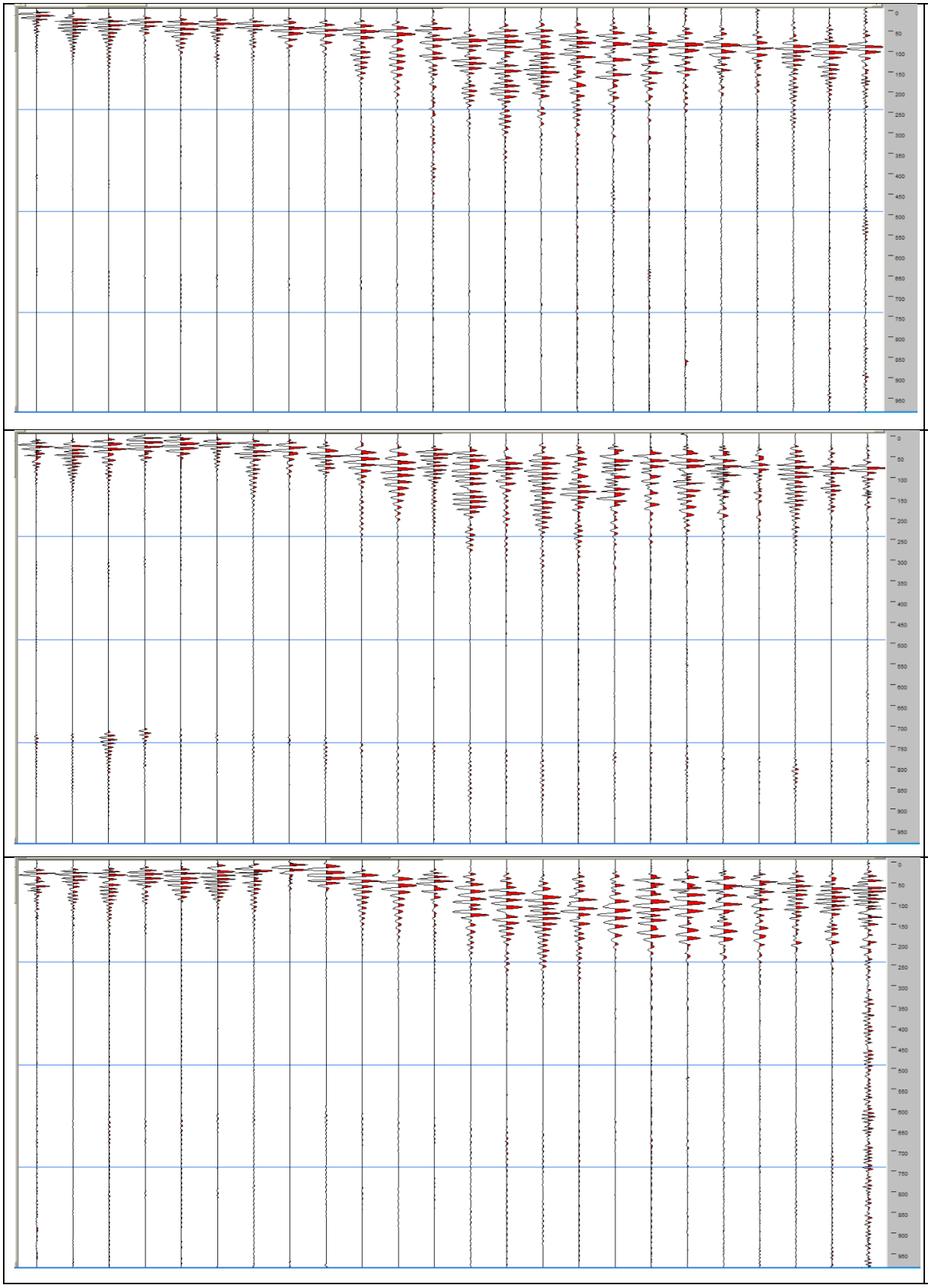


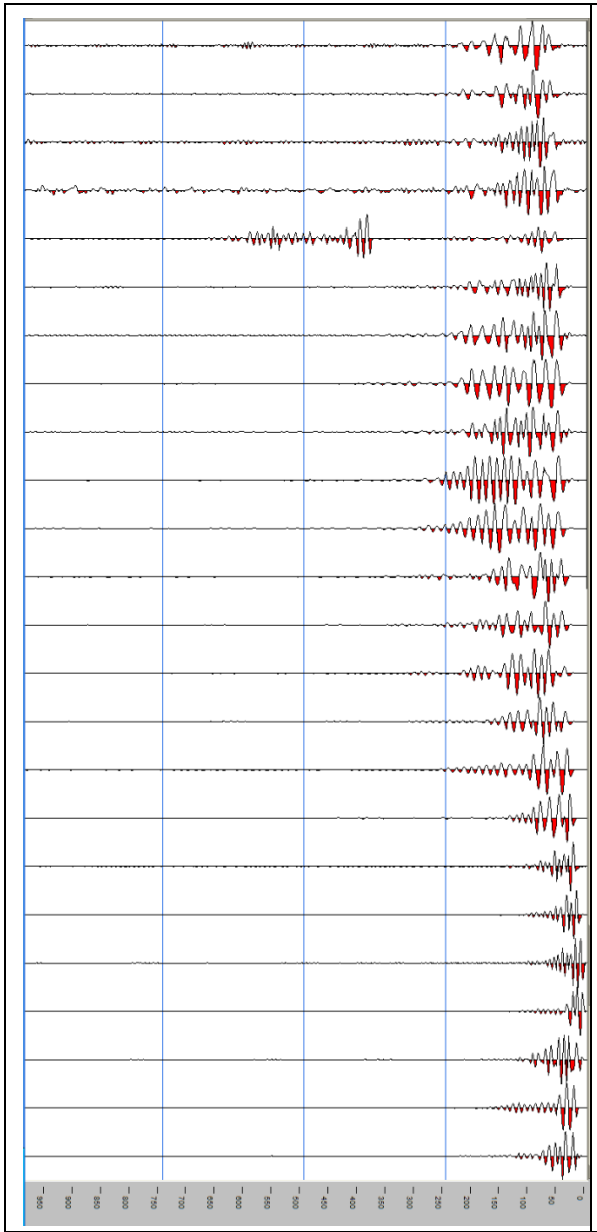
Tabella geometria e tempi onde P

ONDE P				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	3.4	6.6	8.8	11.5	12.8	14.3	16.1	17.4	18.8	19.8	21.8	22.9	23.7	24.5	25.5	26.4	27.1	27.8	28.7	29.5	30.1	30.8	31.6	32.3	Tempo (ms)
	Quota (m)	505.0																										
S2	Progressiva (m)	11.25	PS2	8.5	7.8	5.5	2.4	1.8	3.0	5.7	8.1	10.0	11.5	13.5	15.5	16.5	16.9	17.8	18.2	19.2	20.2	21.0	21.8	22.7	23.5	23.9	24.2	
	Quota (m)	505.0																										
S3	Progressiva (m)	21.25	PS3	16.8	15.5	14.0	12.0	10.2	7.5	5.7	3.0	2.9	7.8	11.4	13.7	14.9	16.3	16.9	17.7	18.2	18.9	19.7	20.2	21.0	21.5	21.9	22.3	
	Quota (m)	505.0																										
S4	Progressiva (m)	31.25	PS4	22.3	21.7	20.5	19.3	18.6	16.4	15.5	14.3	12.8	11.1	9.0	3.7	2.6	7.3	11.4	13.6	14.9	15.7	17.1	17.8	18.4	19.6	20.2	20.8	
	Quota (m)	505.0																										
S5	Progressiva (m)	41.25	PS5	24.6	23.9	23.1	21.8	20.5	19.6	18.6	17.8	16.8	15.1	14.1	13.2	11.6	10.0	7.0	3.2	3.2	7.1	10.6	11.9	13.5	14.1	14.9	15.9	
	Quota (m)	505.0																										
S6	Progressiva (m)	51.25	PS6	25.5	25.1	24.2	23.1	22.3	21.3	20.4	19.3	18.6	17.6	16.8	16.4	16.0	15.2	13.6	12.3	10.4	8.7	7.4	2.5	2.2	6.1	7.5	8.7	
	Quota (m)	505.0																										
S7	Progressiva (m)	61.25	PS7	27.5	27.2	26.7	25.3	24.3	22.9	22.3	21.4	20.8	19.8	19.2	18.9	18.1	17.4	16.5	15.1	13.5	12.2	11.1	9.0	7.9	6.6	5.1	2.5	
	Quota (m)	505.0																										

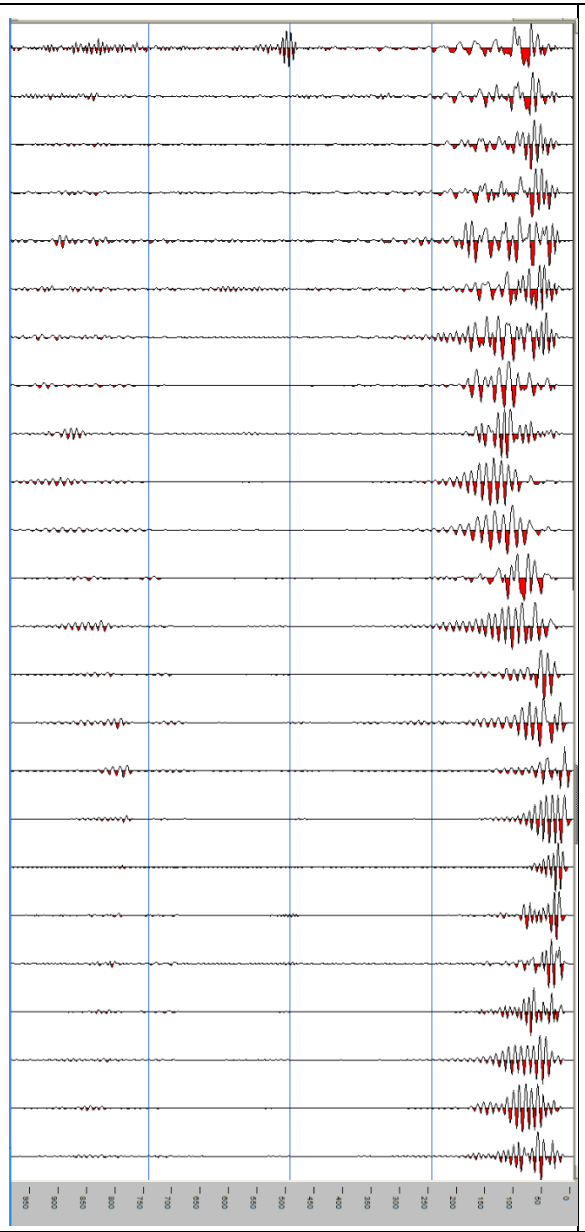


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

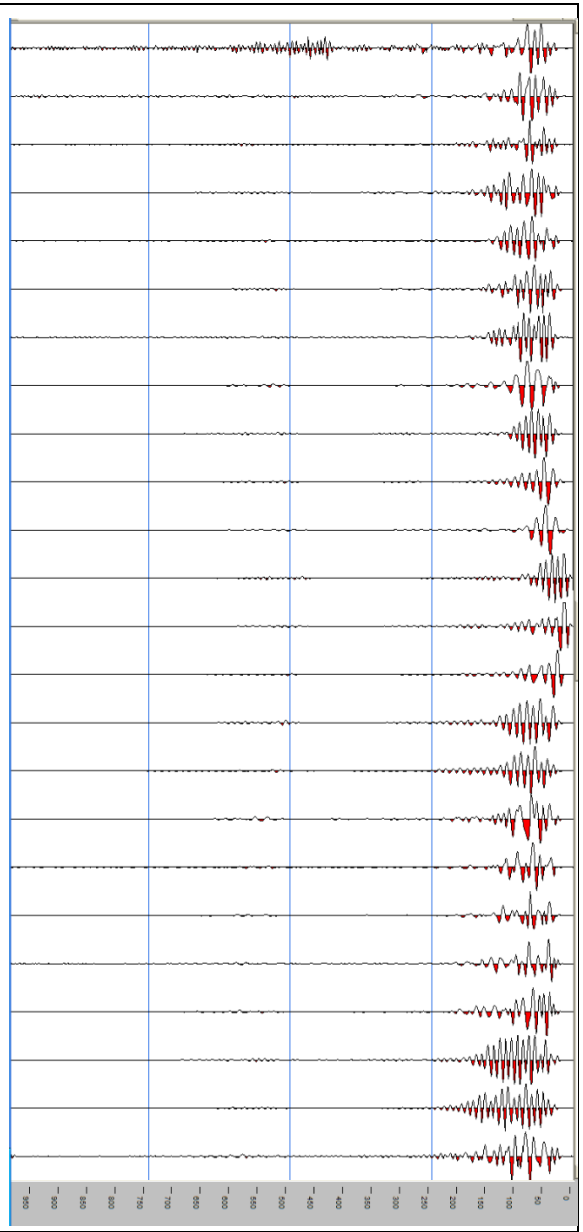




SP6



SP5



SP4

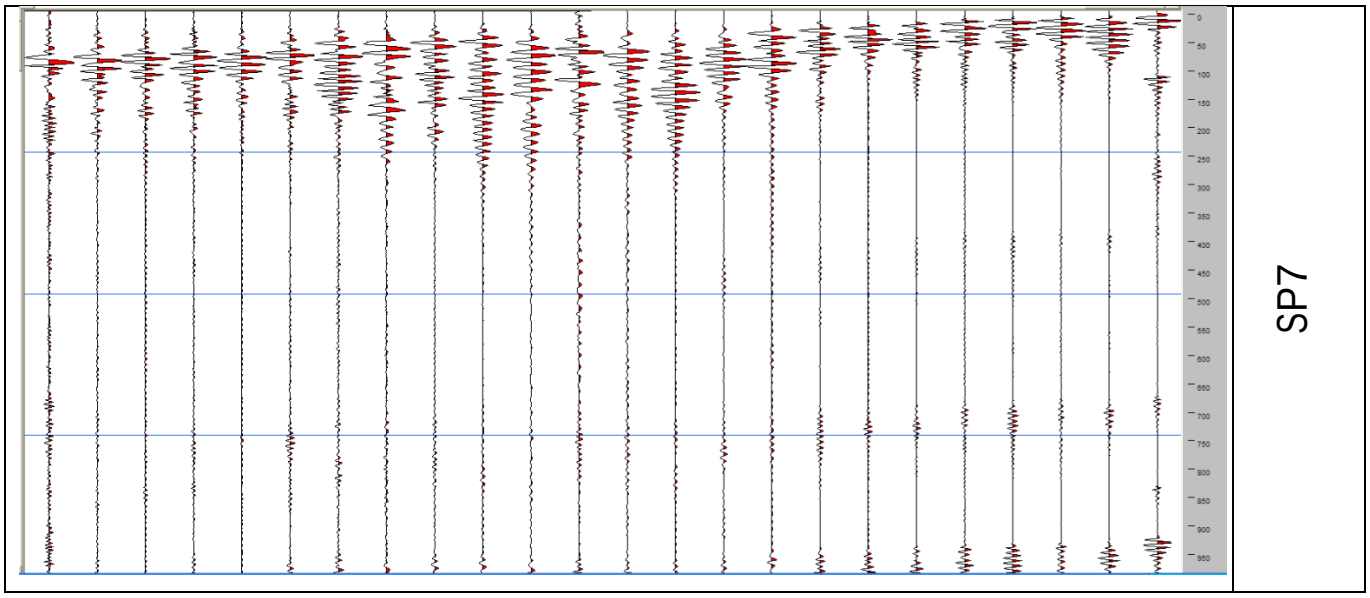
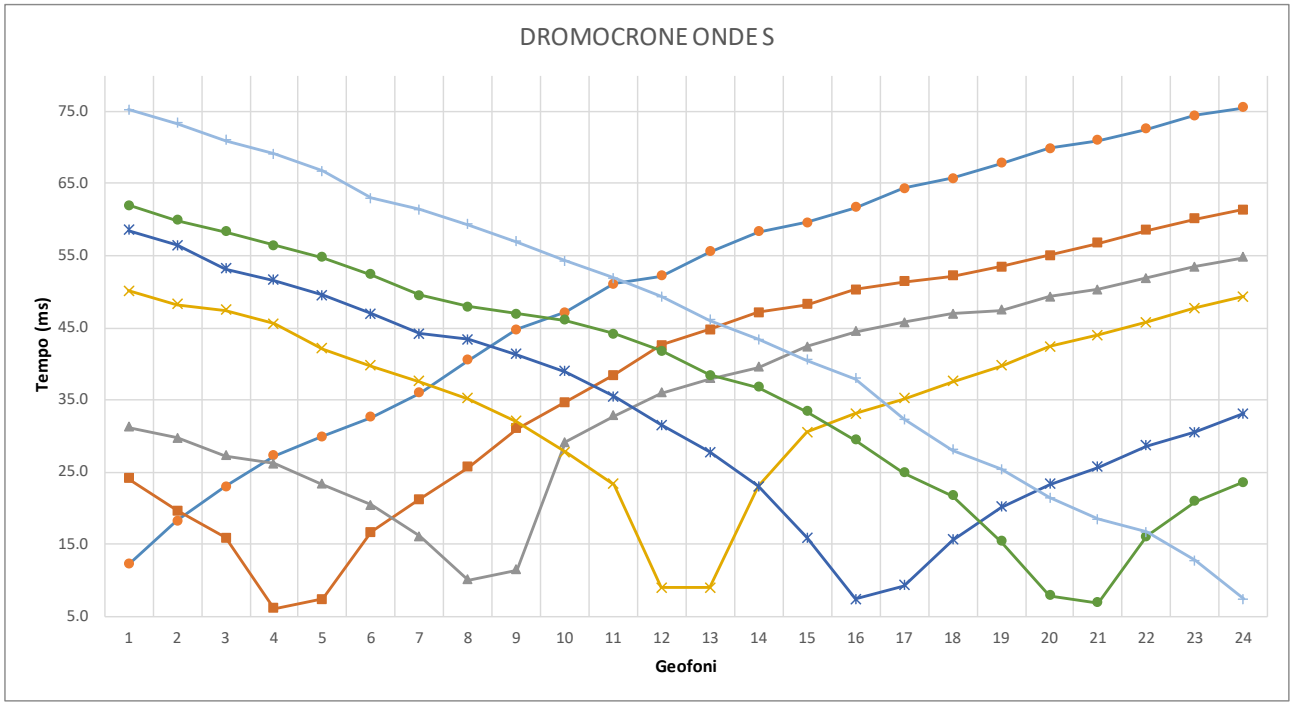


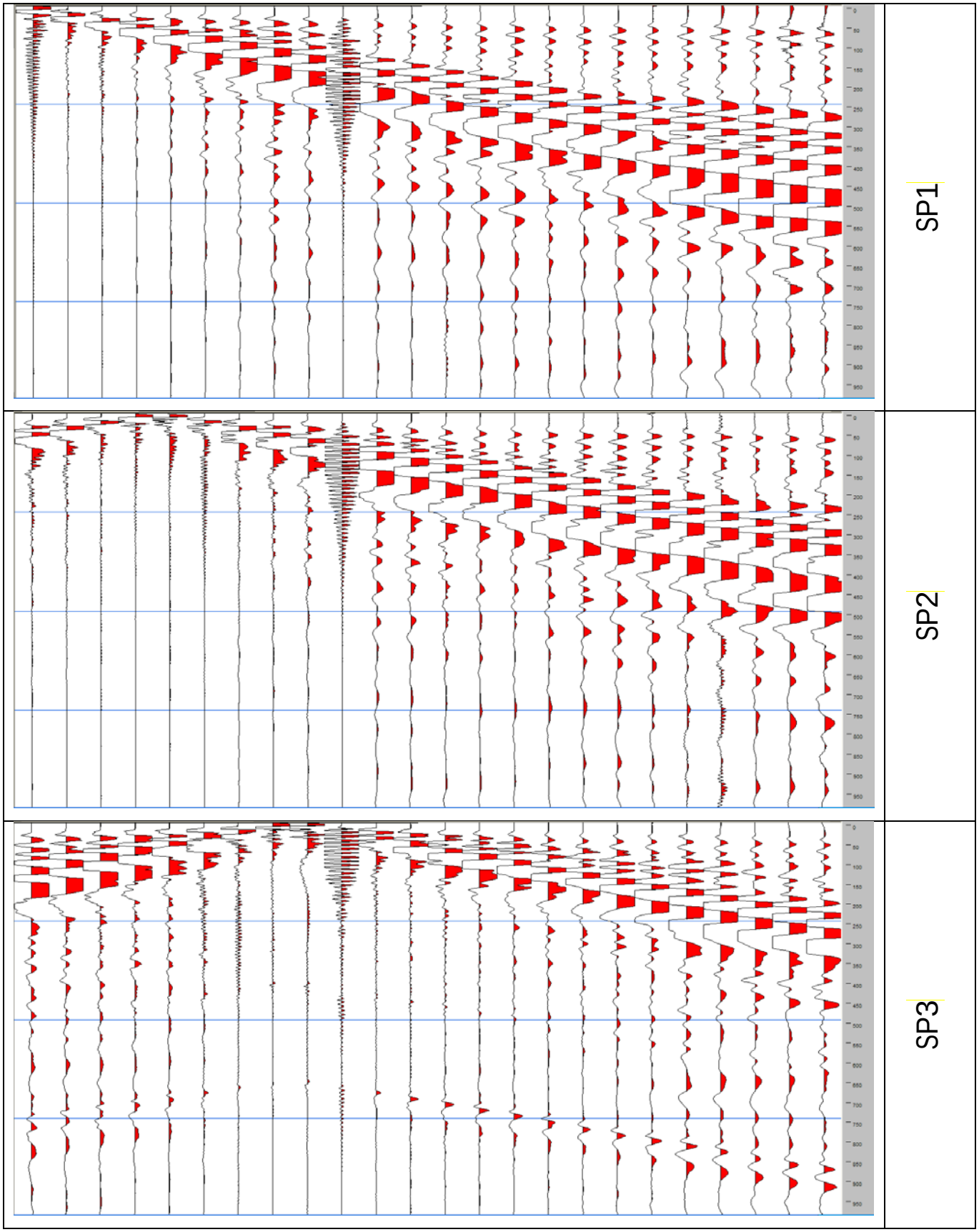
Tabella geometria e tempi onde S

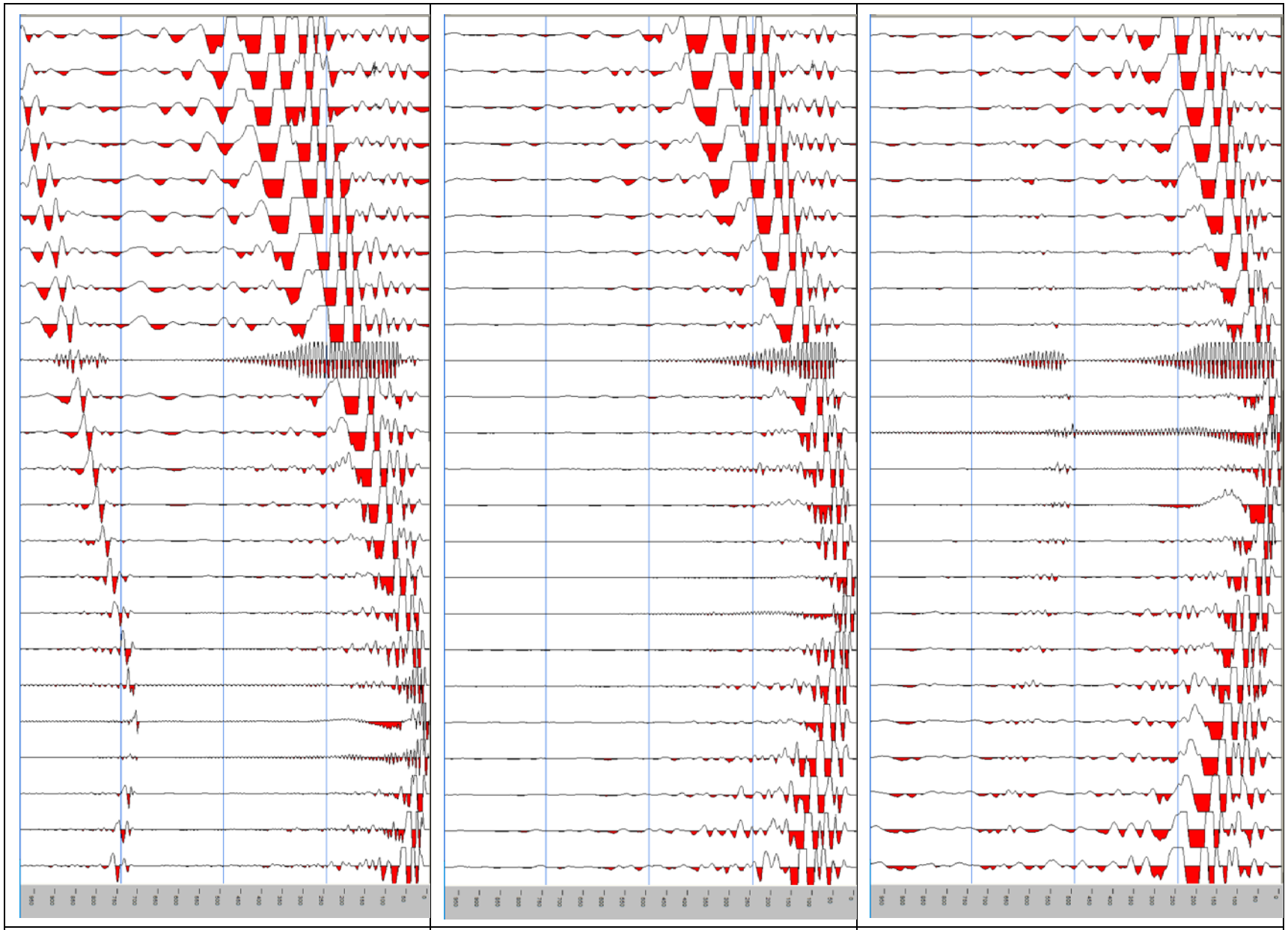
ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	505.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	12.2	18.3	23.0	27.3	29.9	32.6	36.0	40.5	44.8	47.1	51.1	52.2	55.6	58.3	59.6	61.7	64.4	65.7	67.8	69.9	71.0	72.6	74.4	75.5	Tempo (ms)
	Quota (m)	505.0																										
S2	Progressiva (m)	11.25	PS2	24.1	19.6	15.9	6.1	7.4	16.7	21.2	25.7	31.0	34.7	38.4	42.6	44.8	47.1	48.2	50.3	51.4	52.2	53.5	55.1	56.7	58.5	60.1	61.4	
	Quota (m)	505.0																										
S3	Progressiva (m)	21.25	PS3	31.2	29.7	27.3	26.2	23.3	20.4	16.1	10.1	11.4	29.1	32.8	36.0	37.9	39.5	42.4	44.5	45.8	46.9	47.4	49.3	50.3	51.9	53.5	54.8	
	Quota (m)	505.0																										
S4	Progressiva (m)	31.25	PS4	50.1	48.2	47.4	45.6	42.1	39.7	37.6	35.2	32.0	27.8	23.3	9.0	9.0	23.0	30.5	33.1	35.2	37.6	39.7	42.4	44.0	45.8	47.7	49.3	
	Quota (m)	505.0																										
S5	Progressiva (m)	41.25	PS5	58.5	56.4	53.2	51.6	49.5	46.9	44.2	43.4	41.3	38.9	35.5	31.5	27.8	23.0	15.9	7.4	9.3	15.6	20.1	23.3	25.7	28.6	30.5	33.1	
	Quota (m)	505.0																										
S6	Progressiva (m)	51.25	PS6	62.0	59.9	58.3	56.4	54.8	52.4	49.5	47.9	46.9	46.1	44.2	41.8	38.4	36.8	33.4	29.4	24.9	21.7	15.4	7.9	6.9	16.1	20.9	23.6	
	Quota (m)	505.0																										
S7	Progressiva (m)	61.25	PS7	75.2	73.4	71.0	69.1	66.7	63.0	61.4	59.3	56.9	54.3	51.9	49.3	46.1	43.4	40.5	37.9	32.3	28.1	25.4	21.4	18.5	16.7	12.7	7.4	
	Quota (m)	505.0																										



PROFILO SISMICO D

Sismogrammi onde P





SP6	SP5	SP4

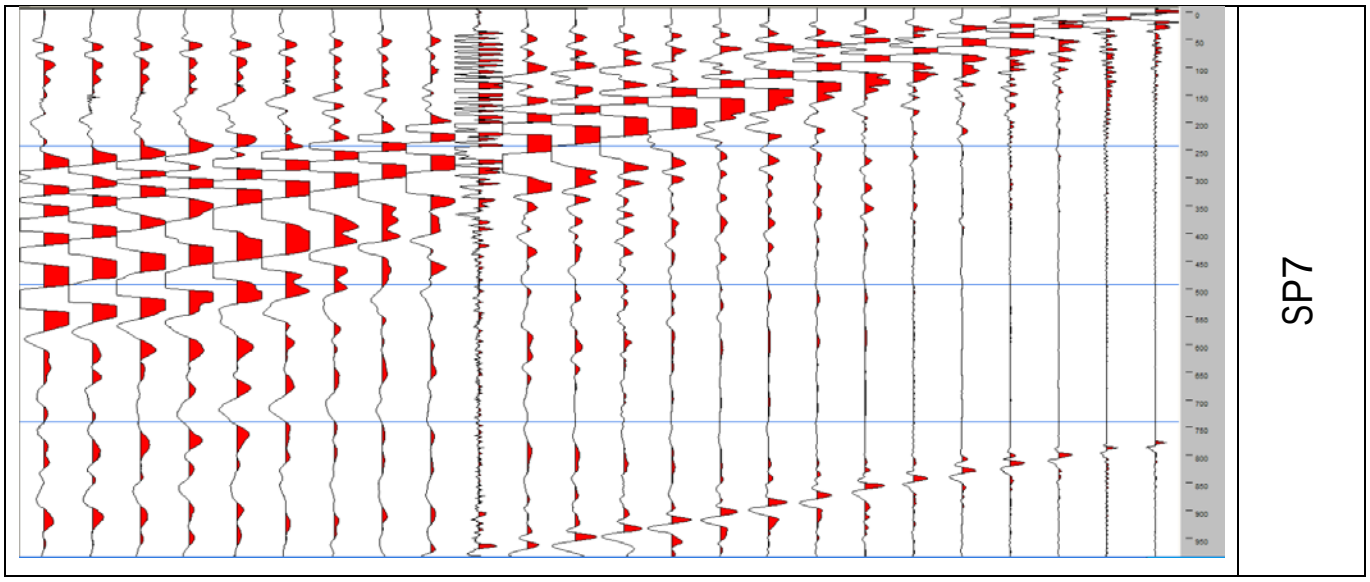
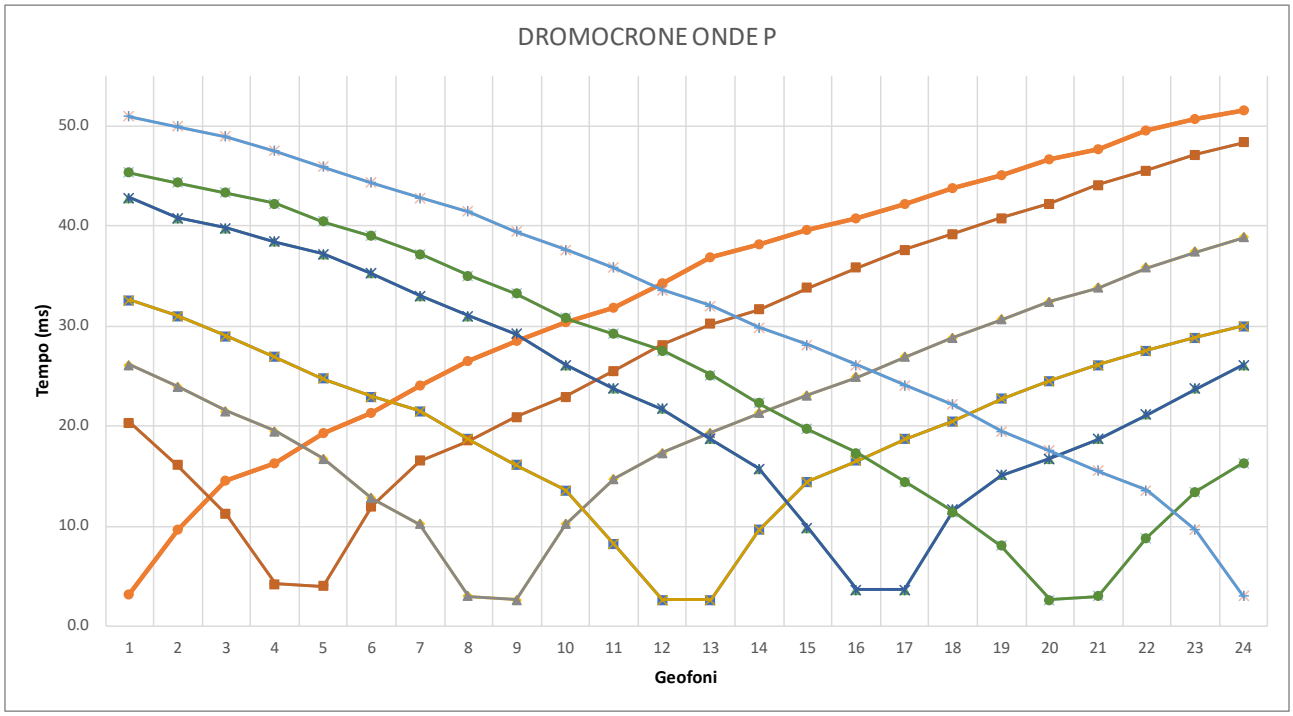
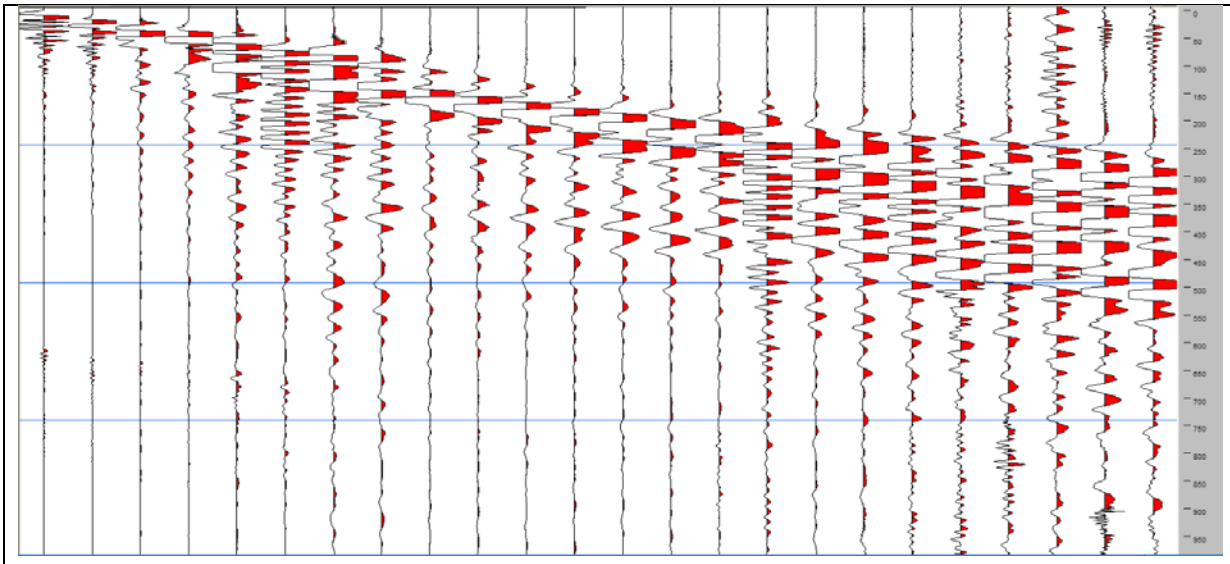


Tabella geometria e tempi onde P

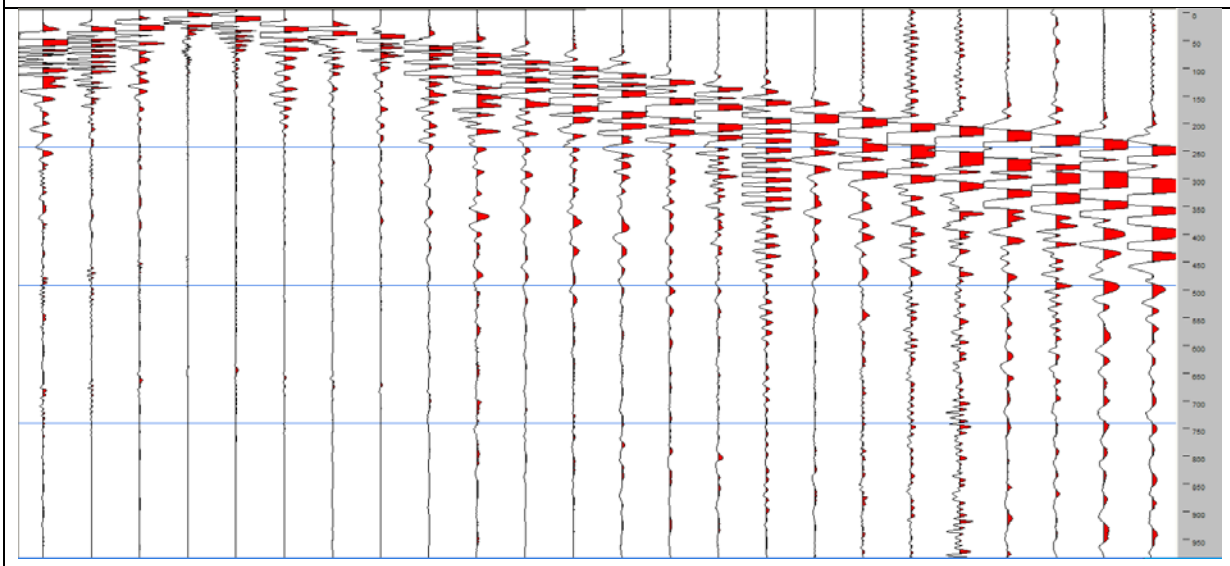
	ONDE P			GEOFONI																							
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	Quota (m)
S1	Progressiva (m)	1.25	PS1	3.2	9.6	14.5	16.3	19.3	21.3	24.1	26.5	28.5	30.4	31.8	34.2	36.8	38.2	39.6	40.8	42.2	43.7	45.1	46.7	47.7	49.5	50.7	51.5	Tempo (ms)
	Quota (m)	154.9																										
S2	Progressiva (m)	11.25	PS2	20.3	16.1	11.2	4.2	4.0	12.0	16.5	18.5	20.9	22.9	25.5	28.1	30.2	31.6	33.8	35.8	37.6	39.2	40.8	42.2	44.1	45.5	47.1	48.3	
	Quota (m)	154.9																										
S3	Progressiva (m)	21.25	PS3	26.1	23.9	21.5	19.5	16.7	12.8	10.2	3.0	2.6	10.2	14.7	17.3	19.3	21.3	23.1	24.9	26.9	28.8	30.6	32.4	33.8	35.8	37.4	38.8	
	Quota (m)	154.9																										
S4	Progressiva (m)	31.25	PS4	32.6	31.0	29.0	26.9	24.7	22.9	21.5	18.7	16.1	13.6	8.2	2.6	2.6	9.6	14.4	16.5	18.7	20.5	22.7	24.5	26.1	27.5	28.8	30.0	
	Quota (m)	154.9																										
S5	Progressiva (m)	41.25	PS5	42.8	40.8	39.8	38.4	37.2	35.2	33.0	31.0	29.2	26.1	23.7	21.7	18.7	15.7	9.8	3.6	3.6	11.6	15.1	16.7	18.7	21.1	23.7	26.1	
	Quota (m)	154.9																										
S6	Progressiva (m)	51.25	PS6	45.3	44.3	43.3	42.2	40.4	39.0	37.2	35.0	33.2	30.8	29.2	27.5	25.1	22.3	19.7	17.3	14.4	11.4	8.0	2.6	3.0	8.8	13.4	16.3	
	Quota (m)	154.9																										
S7	Progressiva (m)	61.25	PS7	50.9	49.9	48.9	47.5	45.9	44.3	42.8	41.4	39.4	37.6	35.8	33.6	32.0	29.8	28.1	26.1	24.1	22.1	19.5	17.5	15.5	13.6	9.6	3.0	
	Quota (m)	154.9																										



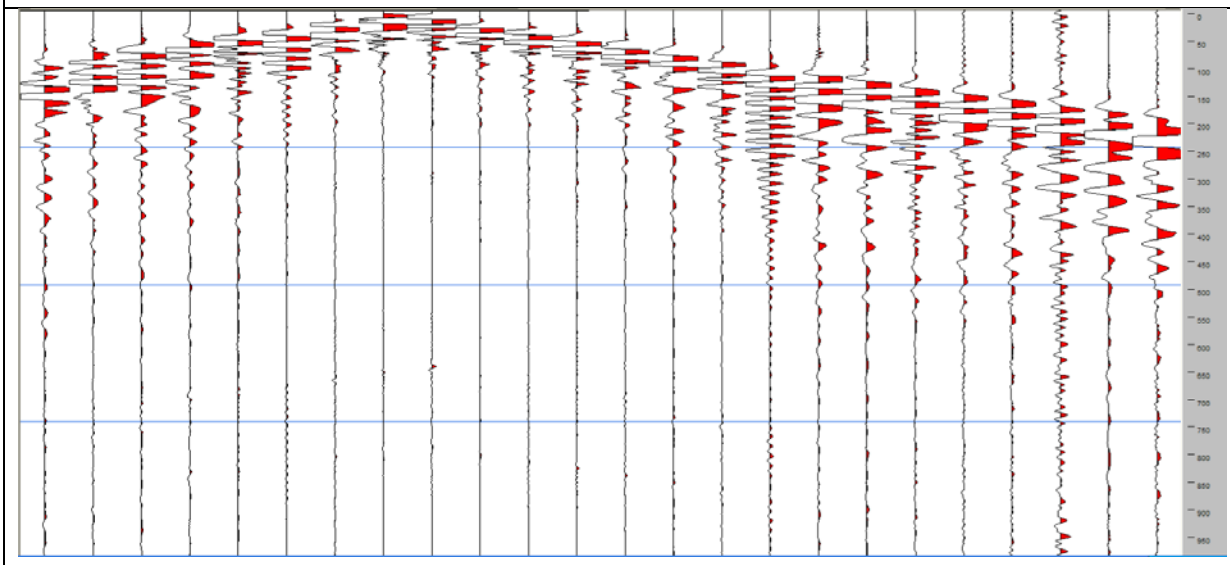
Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)



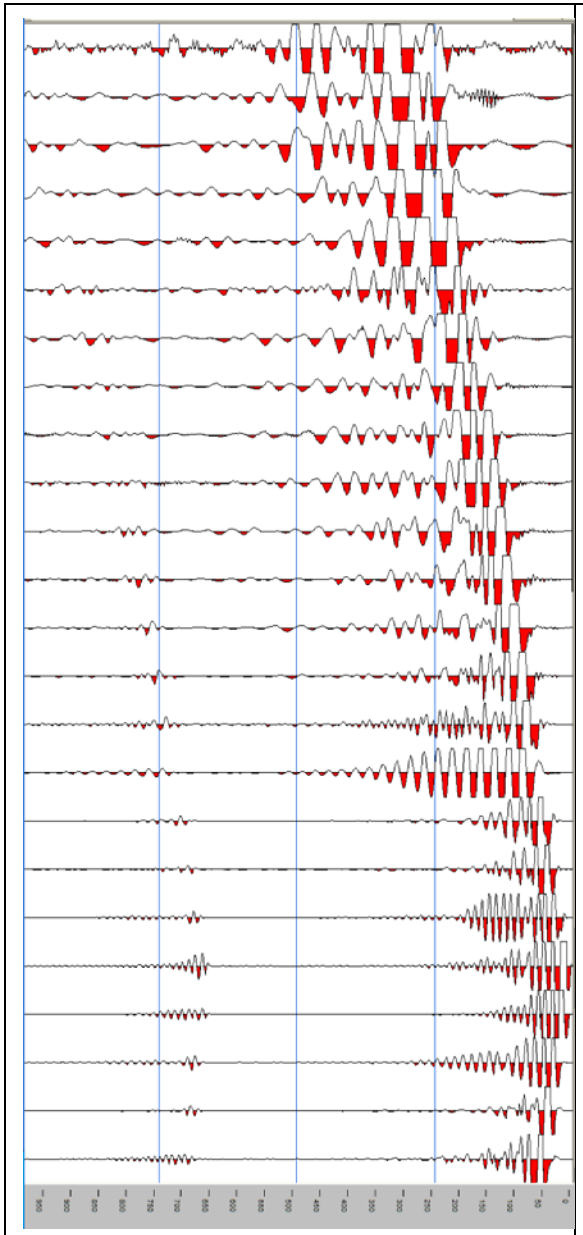
SP1



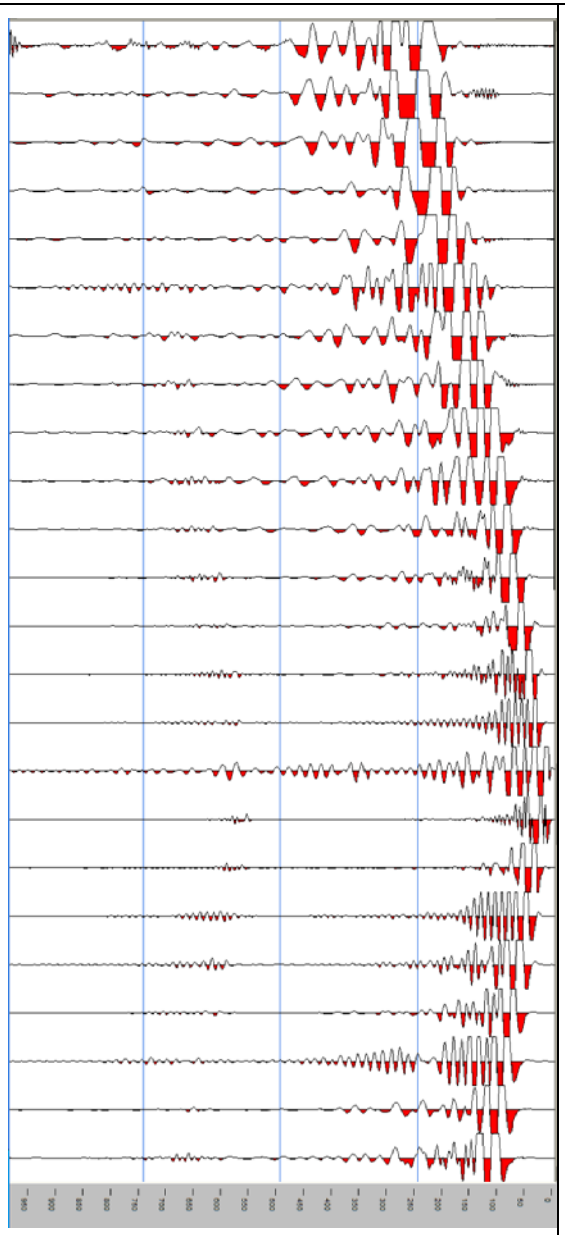
SP2



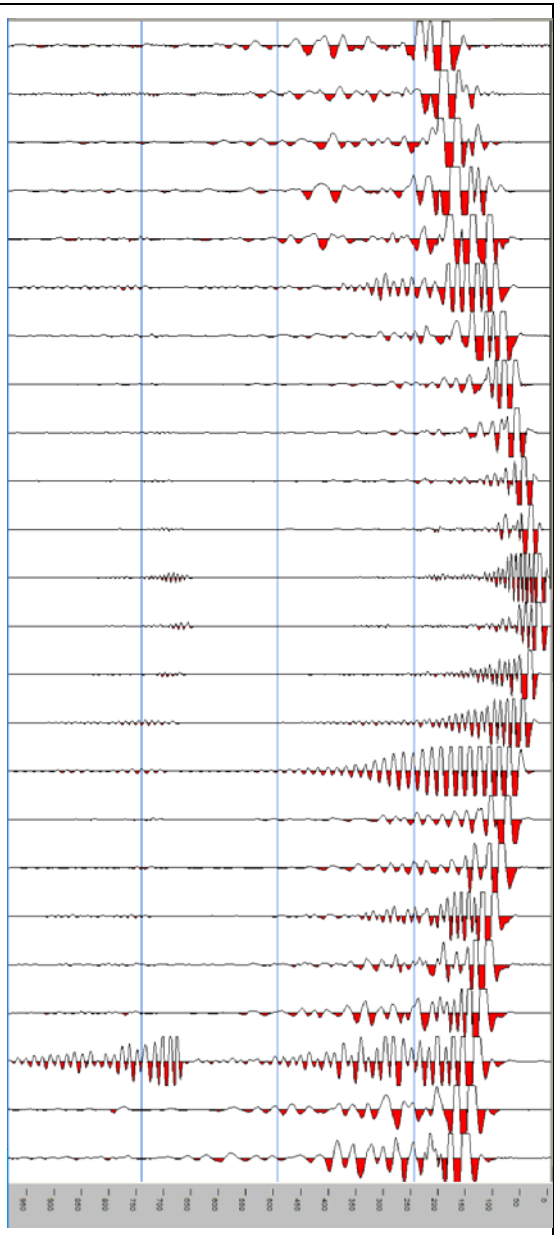
SP3



SP6



SP5



SP4

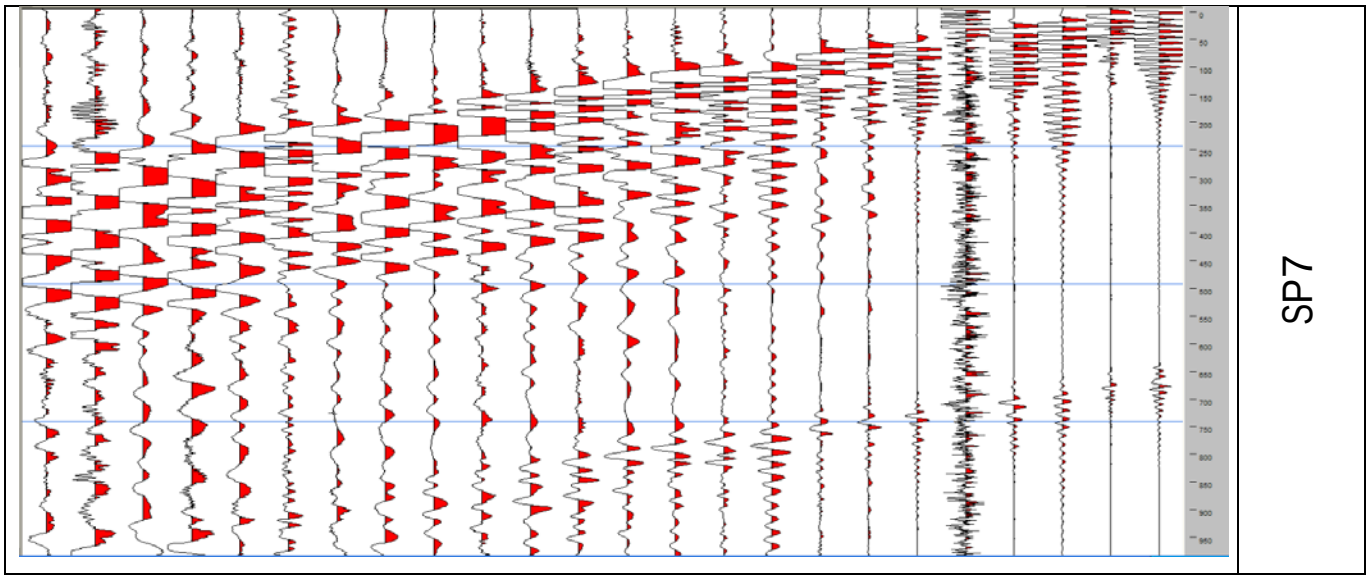
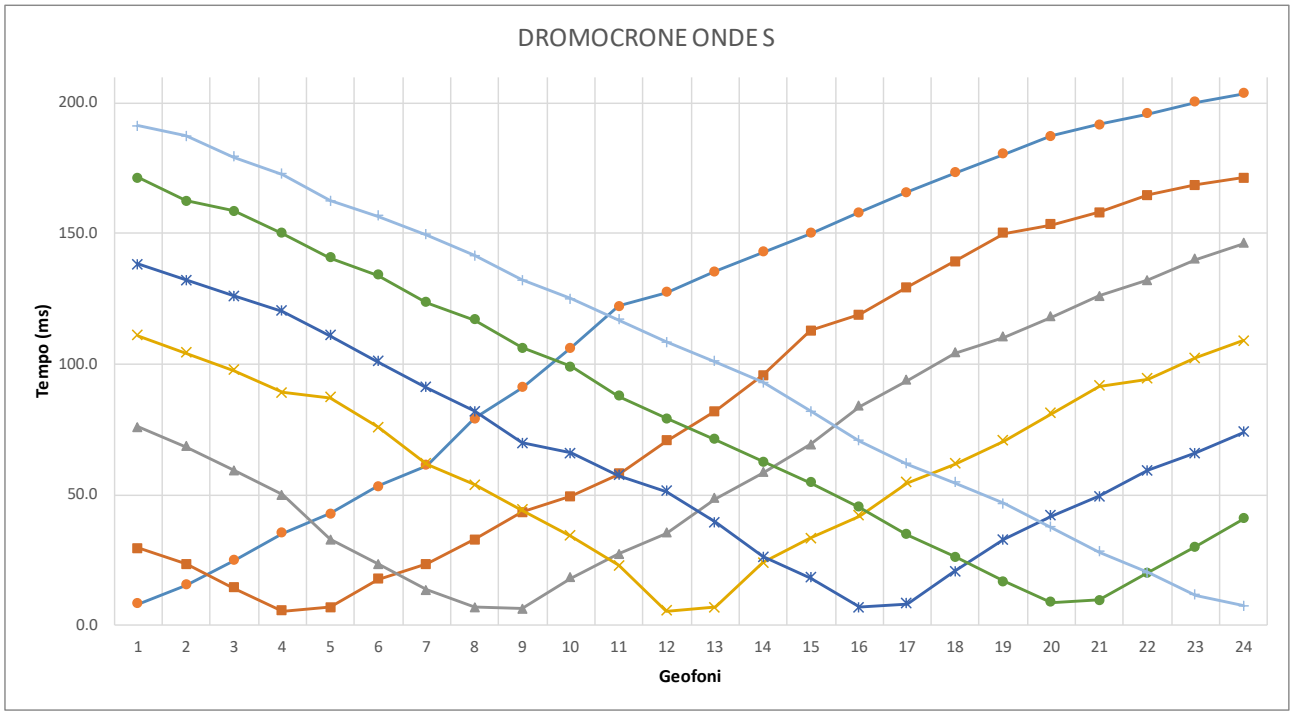


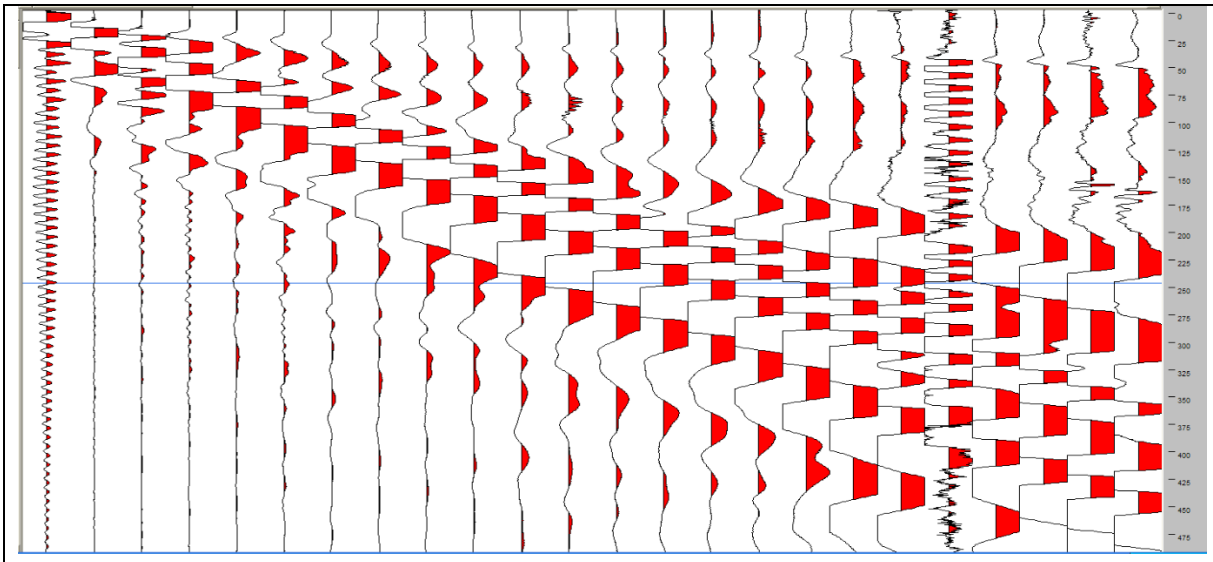
Tabella geometria e tempi onde S

ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	Quota (m)
S1	Progressiva (m)	1.25	PS1	8.2	15.5	24.8	35.4	42.7	53.3	61.2	79.1	91.1	106.3	122.2	127.5	135.5	142.8	150.0	158.0	165.9	173.2	180.5	187.2	191.8	195.8	200.4	203.7	Tempo (ms)
	Quota (m)	154.9																										
S2	Progressiva (m)	11.25	PS2	29.4	23.4	14.2	5.6	6.9	17.5	23.4	32.7	43.3	49.3	57.9	70.5	81.8	95.7	112.9	118.9	129.5	139.4	150.0	153.4	158.0	164.6	168.6	171.3	
	Quota (m)	154.9																										
S3	Progressiva (m)	21.25	PS3	75.8	68.5	59.2	50.0	32.7	23.4	13.5	6.9	6.2	18.1	27.4	35.4	48.6	58.6	69.2	83.8	93.7	104.3	110.3	118.2	126.2	132.1	140.1	146.1	
	Quota (m)	154.9																										
S4	Progressiva (m)	31.25	PS4	110.9	104.3	97.7	89.1	87.1	75.8	61.9	53.9	44.0	34.1	22.8	5.6	6.9	24.1	33.4	42.0	54.6	61.9	70.5	81.1	91.7	94.4	102.3	108.9	
	Quota (m)	154.9																										
S5	Progressiva (m)	41.25	PS5	138.1	132.1	126.2	120.2	110.9	101.0	91.1	81.8	69.8	65.9	57.3	51.3	39.4	26.1	18.1	6.9	8.2	20.8	32.7	42.0	49.3	59.2	65.9	73.8	
	Quota (m)	154.9																										
S6	Progressiva (m)	51.25	PS6	171.3	162.6	158.7	150.0	140.8	134.1	123.5	116.9	106.3	99.0	87.7	79.1	71.2	62.6	54.6	45.3	34.7	26.1	16.8	8.9	9.5	20.1	30.1	40.7	
	Quota (m)	154.9																										
S7	Progressiva (m)	61.25	PS7	191.1	187.2	179.2	172.6	162.6	156.7	149.4	141.4	132.1	124.9	116.9	108.3	101.0	93.0	81.8	70.5	61.9	54.6	46.6	37.4	28.1	20.1	11.5	7.4	
	Quota (m)	154.9																										

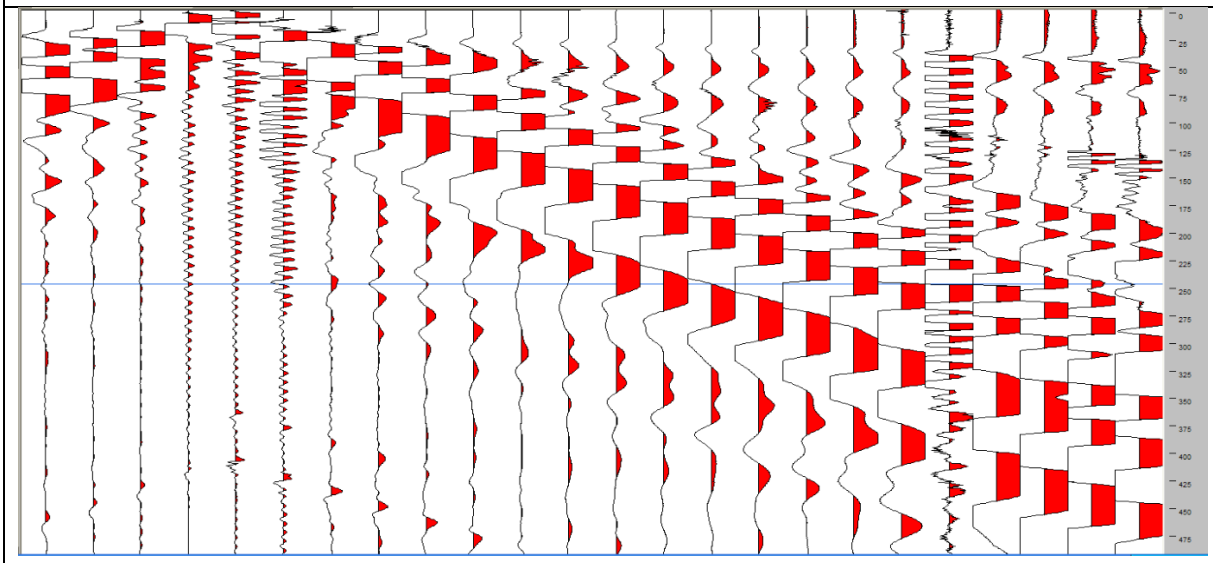


PROFILO SISMICO E

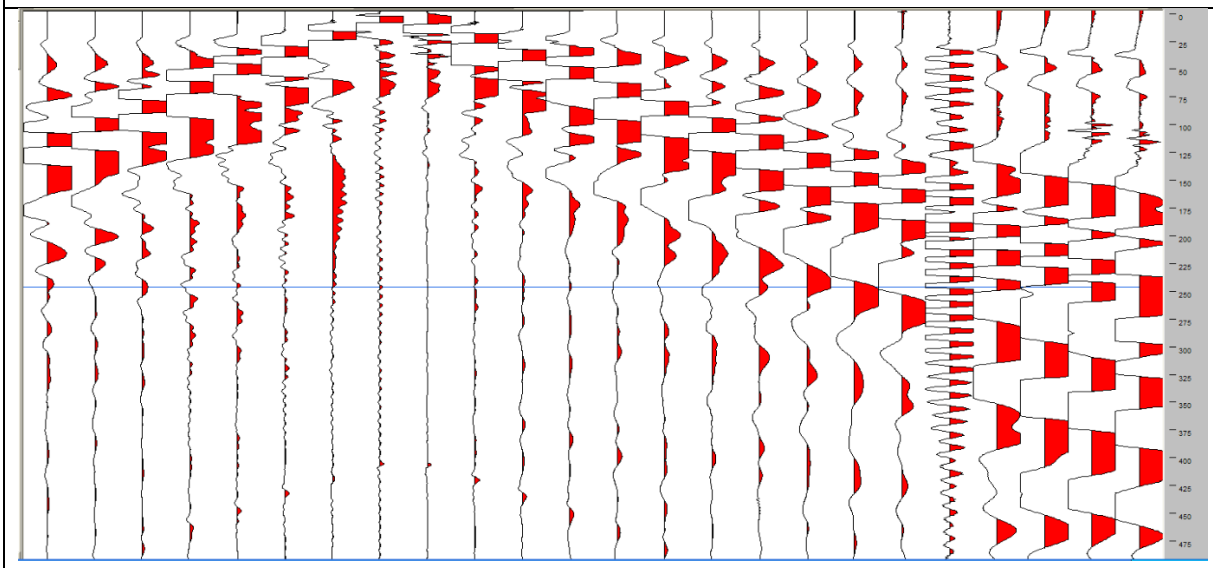
Sismogrammi onde P



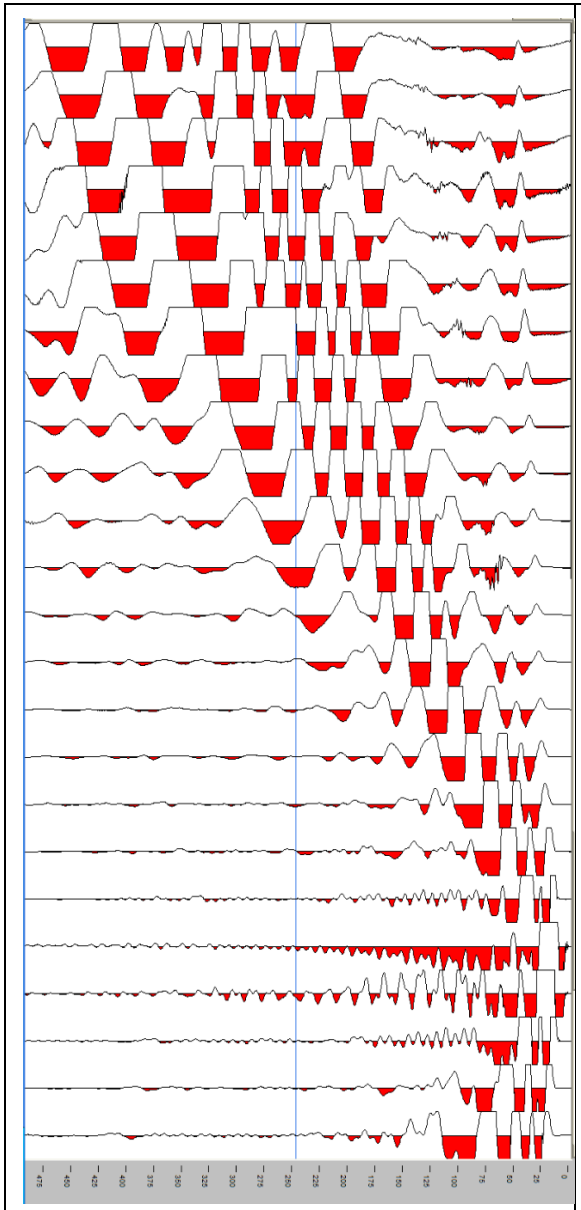
SP1



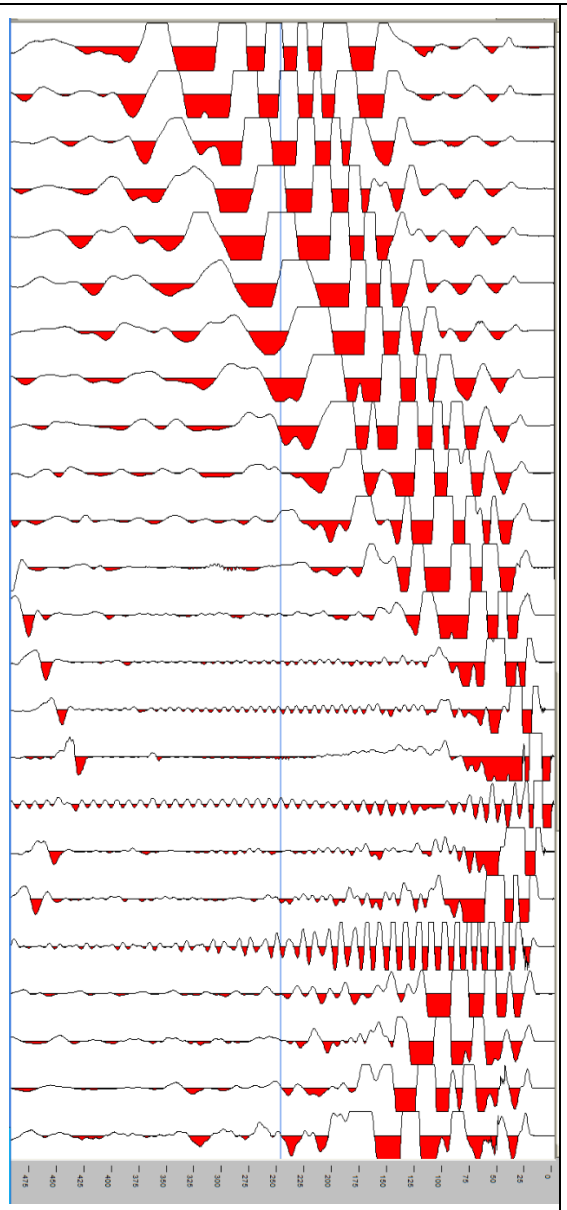
SP2



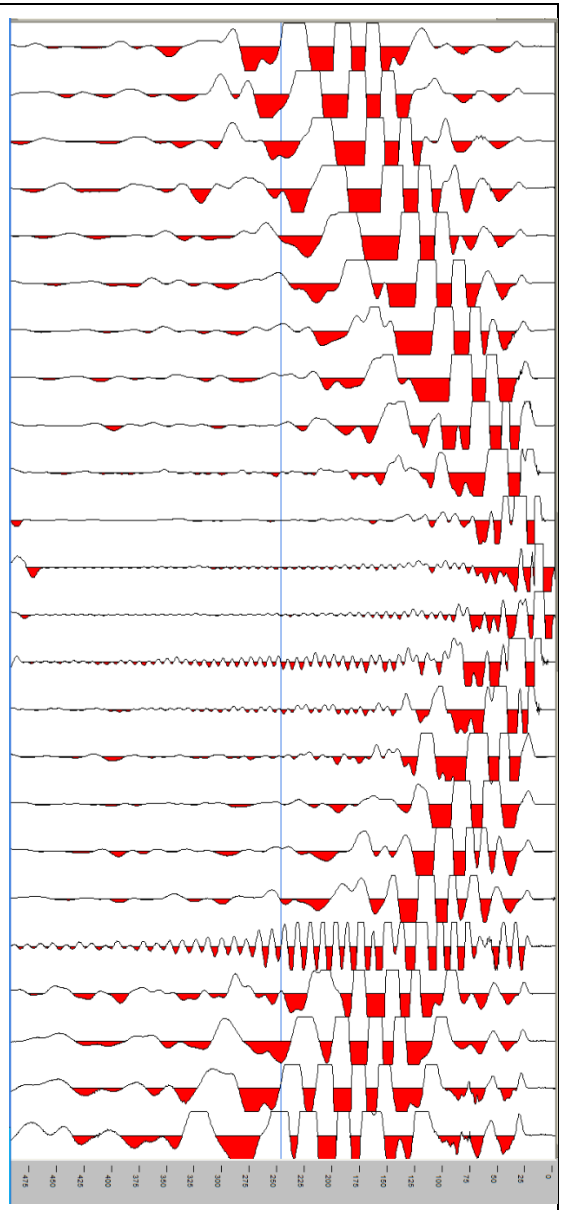
SP3



SP6



SP5



SP4

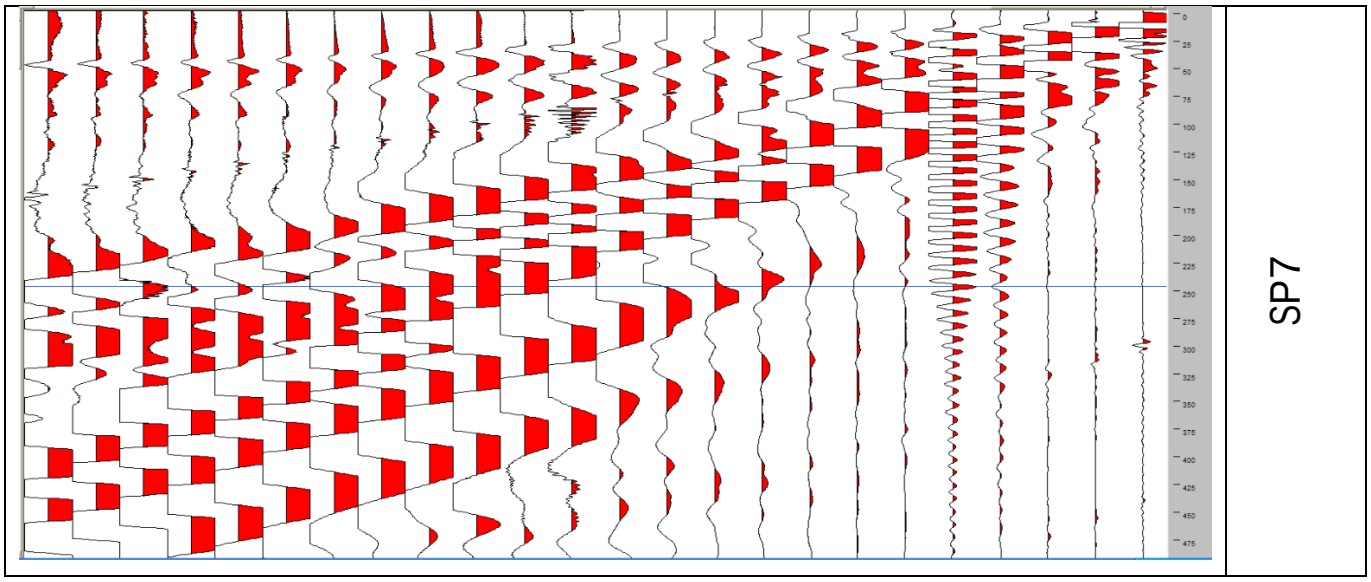
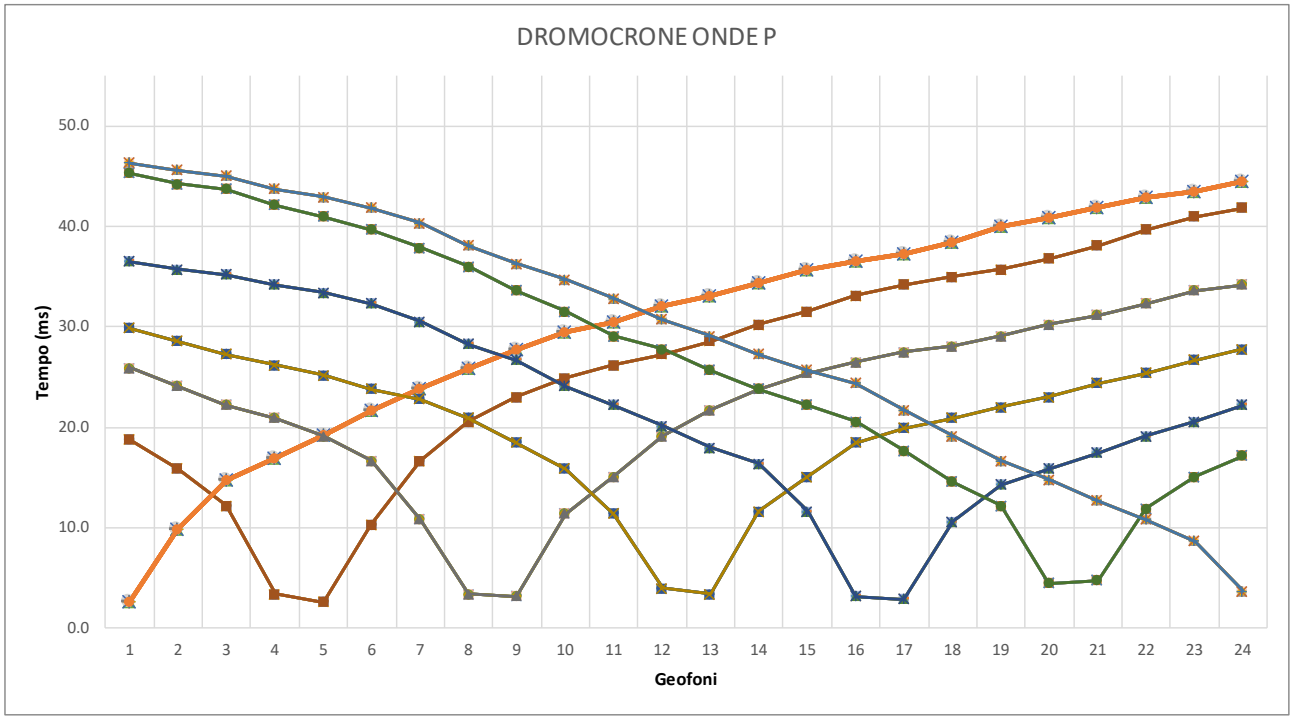
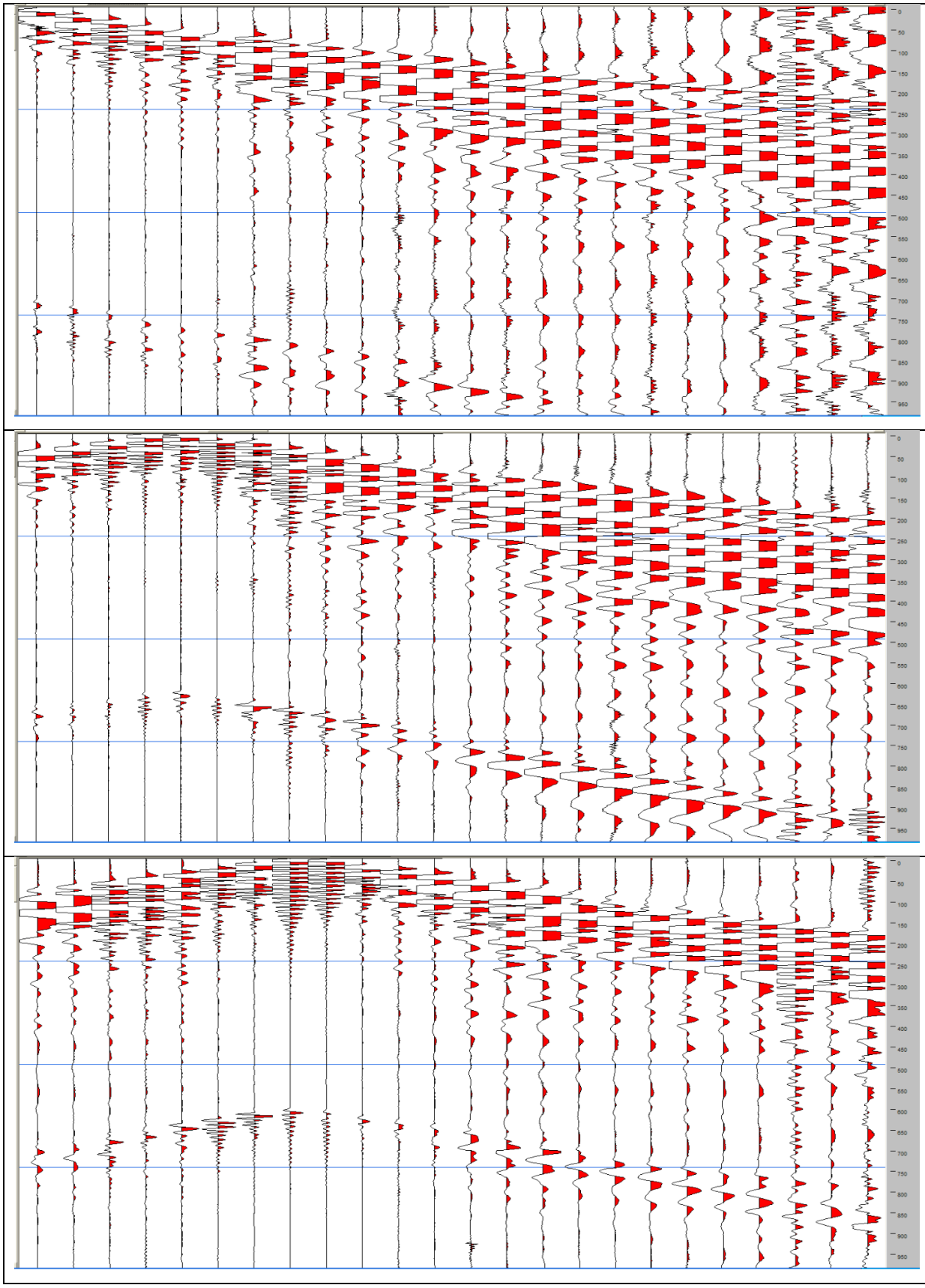


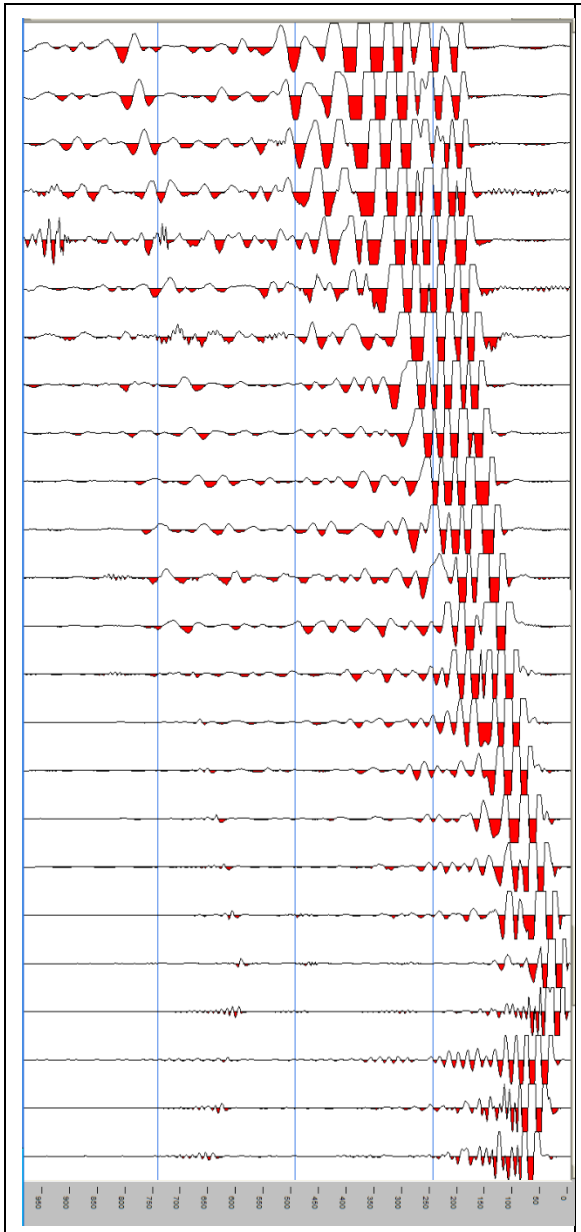
Tabella geometria e tempi onde P

ONDE P				GEOFONI																							
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	2.6	9.8	14.8	16.9	19.3	21.7	23.8	25.9	27.8	29.4	30.5	32.0	33.1	34.4	35.7	36.5	37.3	38.4	40.0	40.8	41.8	42.9	43.4	44.5	Tempo (ms)
	Quota (m)	154.0																										
S2	Progressiva (m)	11.25	PS2	18.8	15.9	12.2	3.4	2.6	10.3	16.7	20.6	23.0	24.9	26.2	27.3	28.6	30.2	31.5	33.1	34.2	35.0	35.7	36.8	38.1	39.7	41.0	41.8	
	Quota (m)	154.0																										
S3	Progressiva (m)	21.25	PS3	25.9	24.1	22.2	20.9	19.1	16.7	10.8	3.4	3.2	11.4	15.1	19.1	21.7	23.8	25.4	26.5	27.5	28.1	29.1	30.2	31.2	32.3	33.6	34.2	
	Quota (m)	154.0																										
S4	Progressiva (m)	31.25	PS4	29.9	28.6	27.3	26.2	25.2	23.8	22.8	20.9	18.5	15.9	11.4	4.0	3.4	11.6	15.1	18.5	19.9	20.9	22.0	23.0	24.4	25.4	26.7	27.8	
	Quota (m)	154.0																										
S5	Progressiva (m)	41.25	PS5	36.5	35.7	35.2	34.2	33.4	32.3	30.5	28.3	26.7	24.1	22.2	20.1	18.0	16.4	11.6	3.2	2.9	10.6	14.3	15.9	17.5	19.1	20.6	22.2	
	Quota (m)	154.0																										
S6	Progressiva (m)	51.25	PS6	45.3	44.2	43.7	42.1	41.0	39.7	37.9	36.0	33.6	31.5	29.1	27.8	25.7	23.8	22.2	20.6	17.7	14.6	12.2	4.5	4.8	11.9	15.1	17.2	
	Quota (m)	154.0																										
S7	Progressiva (m)	61.25	PS7	46.3	45.6	45.0	43.7	42.9	41.8	40.3	38.1	36.3	34.7	32.8	30.7	29.1	27.3	25.7	24.4	21.7	19.1	16.7	14.8	12.7	10.8	8.7	3.7	
	Quota (m)	154.0																										

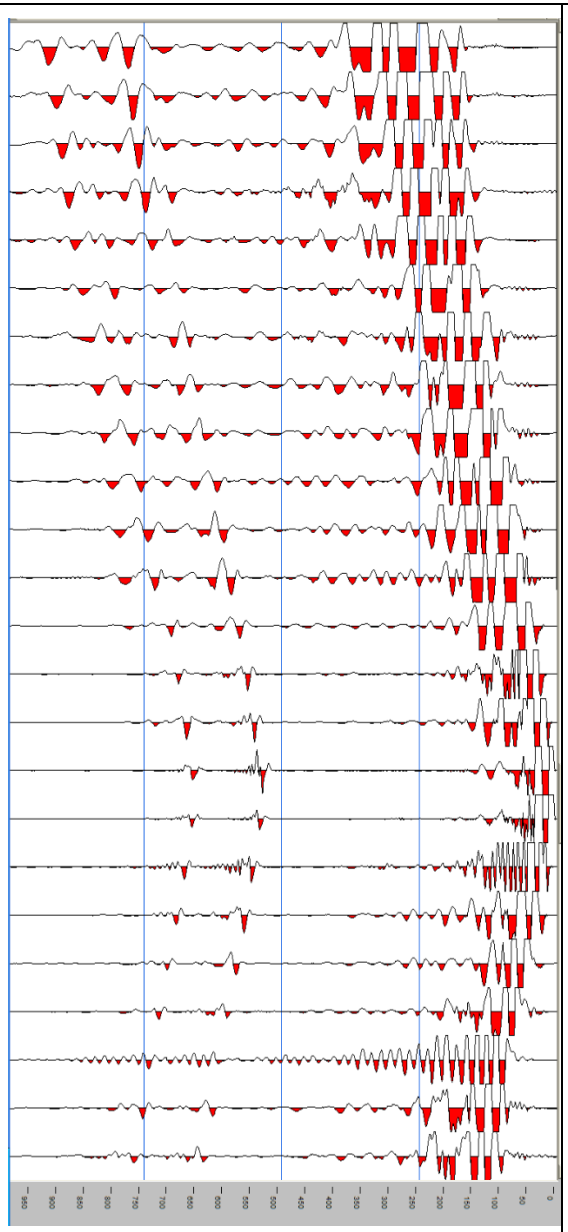


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

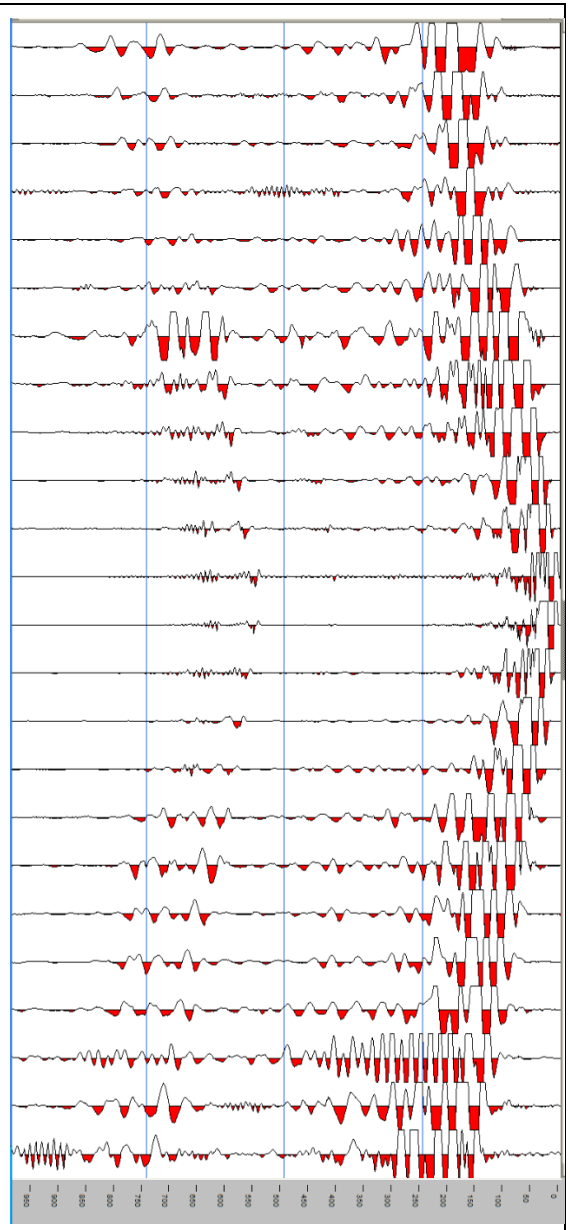




SP6



SP5



SP4

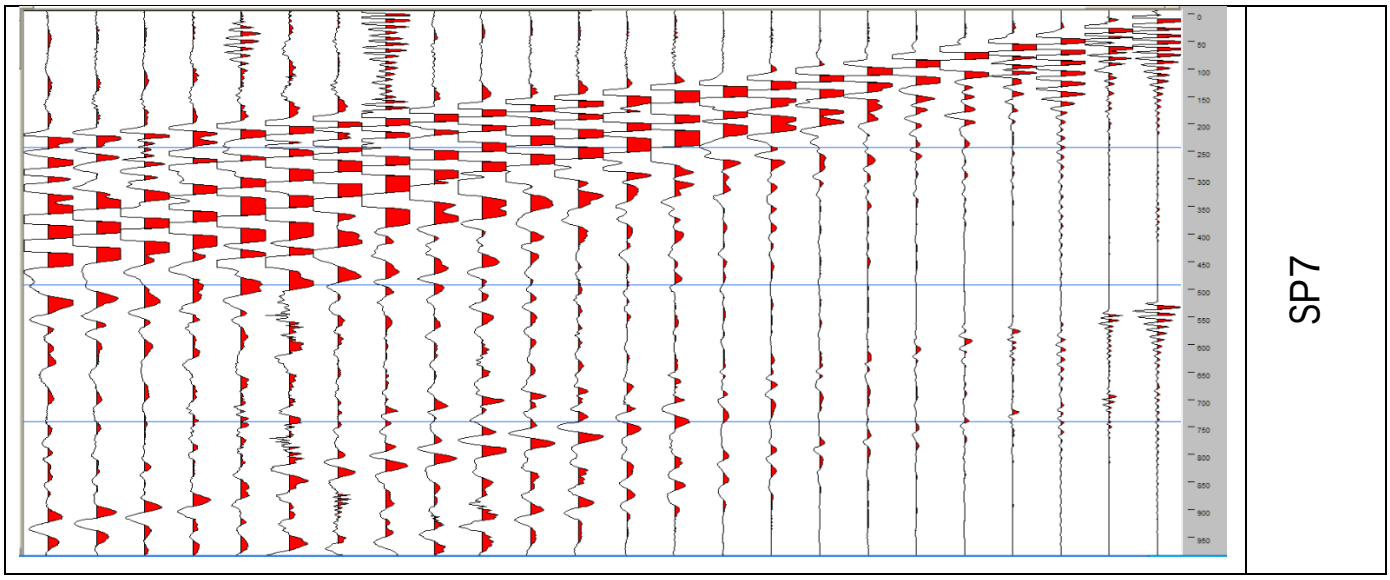
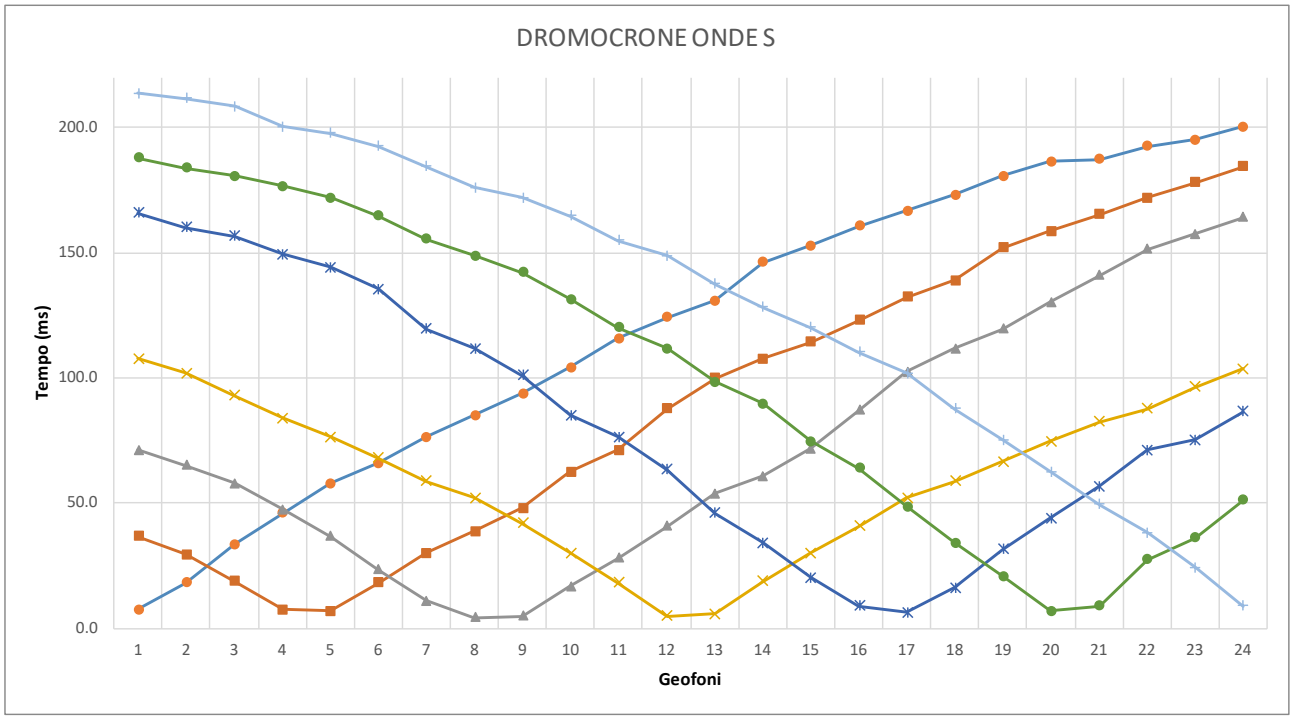


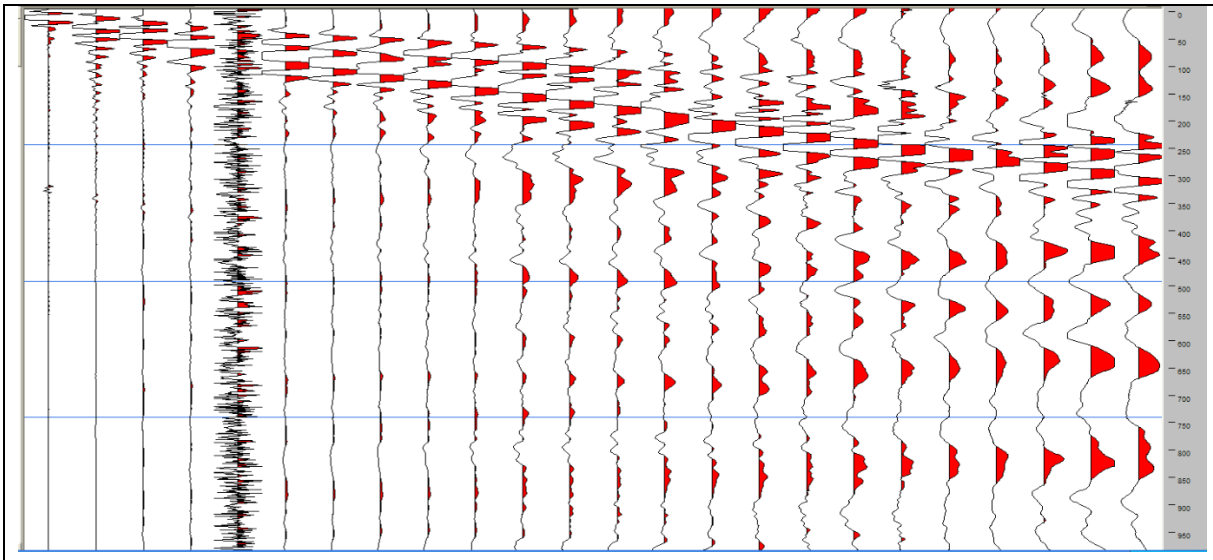
Tabella geometria e tempi onde S

ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	154.9	Quota (m)
S1	Progressiva (m)	1.25	PS1	7.5	18.1	33.4	46.0	57.9	65.9	76.5	85.1	93.7	104.3	115.6	124.2	130.8	146.1	152.7	160.6	166.6	173.2	180.5	186.5	187.2	192.5	195.1	200.4	Tempo (ms)
	Quota (m)	154.0																										
S2	Progressiva (m)	11.25	PS2	36.7	29.4	18.8	7.5	6.9	18.1	30.1	38.7	48.0	62.6	71.2	87.7	99.7	107.6	114.3	122.9	132.1	138.8	152.0	158.7	165.3	171.9	177.9	184.5	
	Quota (m)	154.0																										
S3	Progressiva (m)	21.25	PS3	71.2	65.2	57.9	47.3	36.7	23.4	10.9	4.2	4.9	16.8	28.1	40.7	53.9	60.6	71.8	87.1	102.3	111.6	119.6	130.2	140.8	151.4	157.3	164.0	
	Quota (m)	154.0																										
S4	Progressiva (m)	31.25	PS4	107.6	101.7	93.0	83.8	76.5	67.9	58.6	51.9	42.0	30.1	18.1	4.9	5.6	18.8	30.1	40.7	51.9	58.6	66.5	74.5	82.4	87.7	96.4	103.6	
	Quota (m)	154.0																										
S5	Progressiva (m)	41.25	PS5	165.9	160.0	156.7	149.4	144.1	135.5	119.6	111.6	101.0	85.1	76.5	63.2	46.0	34.1	20.1	8.9	6.2	16.2	31.4	44.0	56.6	71.2	75.1	86.4	
	Quota (m)	154.0																										
S6	Progressiva (m)	51.25	PS6	187.8	183.8	180.5	176.6	171.9	164.6	155.3	148.7	142.1	131.5	120.2	111.6	98.3	89.7	74.5	63.9	48.6	34.1	20.8	6.9	8.9	27.4	36.0	51.3	
	Quota (m)	154.0																										
S7	Progressiva (m)	61.25	PS7	213.7	211.7	208.4	200.4	197.8	192.5	184.5	175.9	171.9	164.6	154.7	148.7	137.4	128.2	120.2	110.3	101.7	87.7	75.1	62.6	49.3	38.0	24.1	8.9	
	Quota (m)	154.0																										

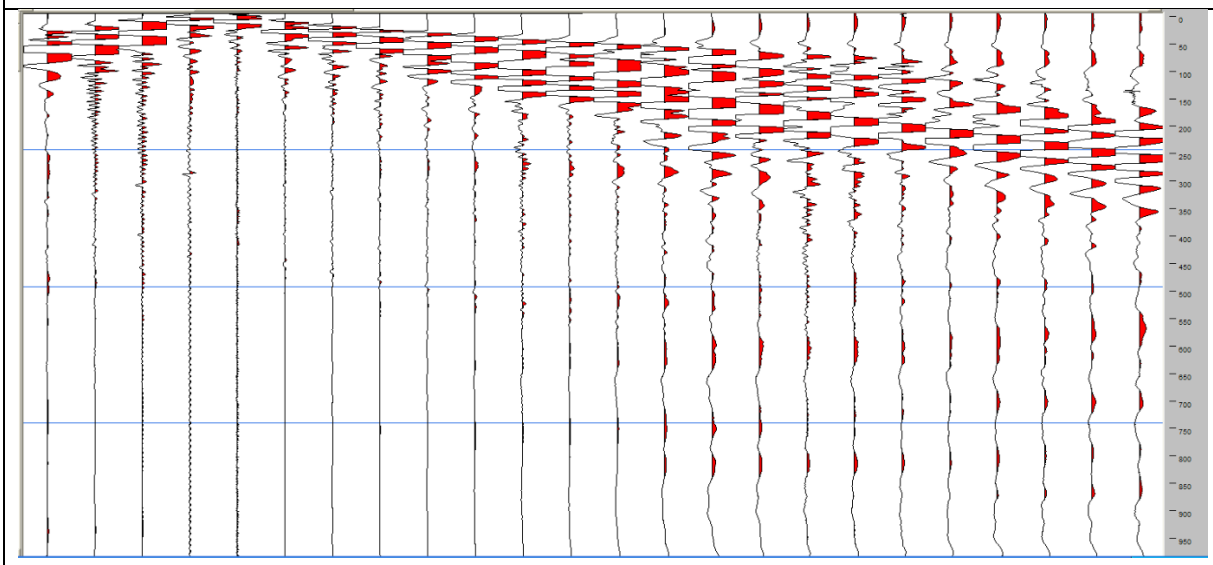


PROFILO SISMICO F

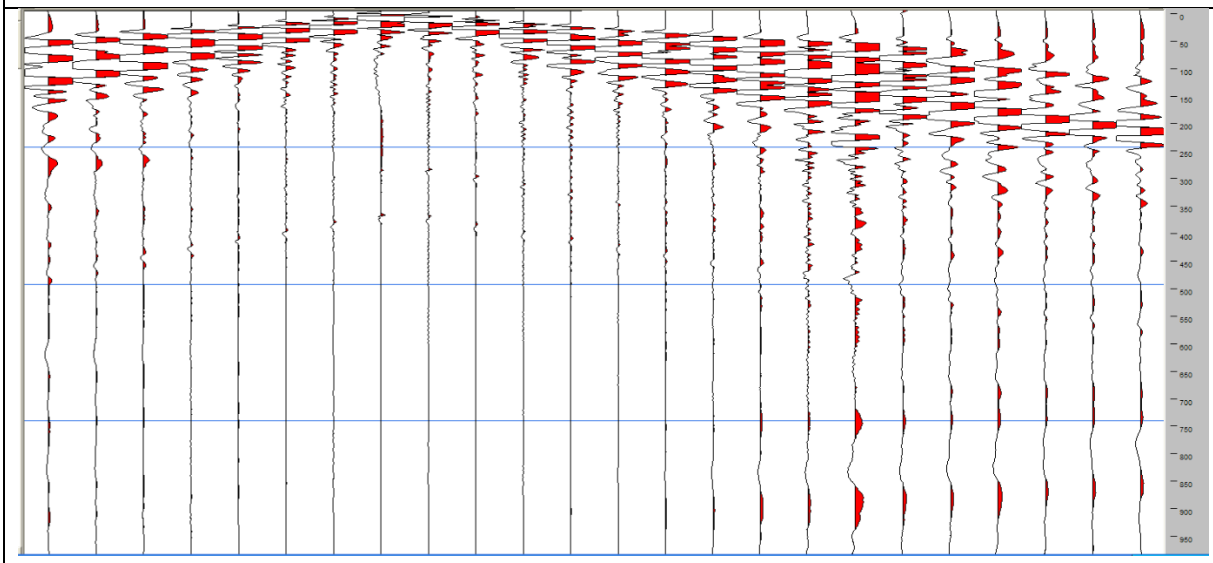
Sismogrammi onde P



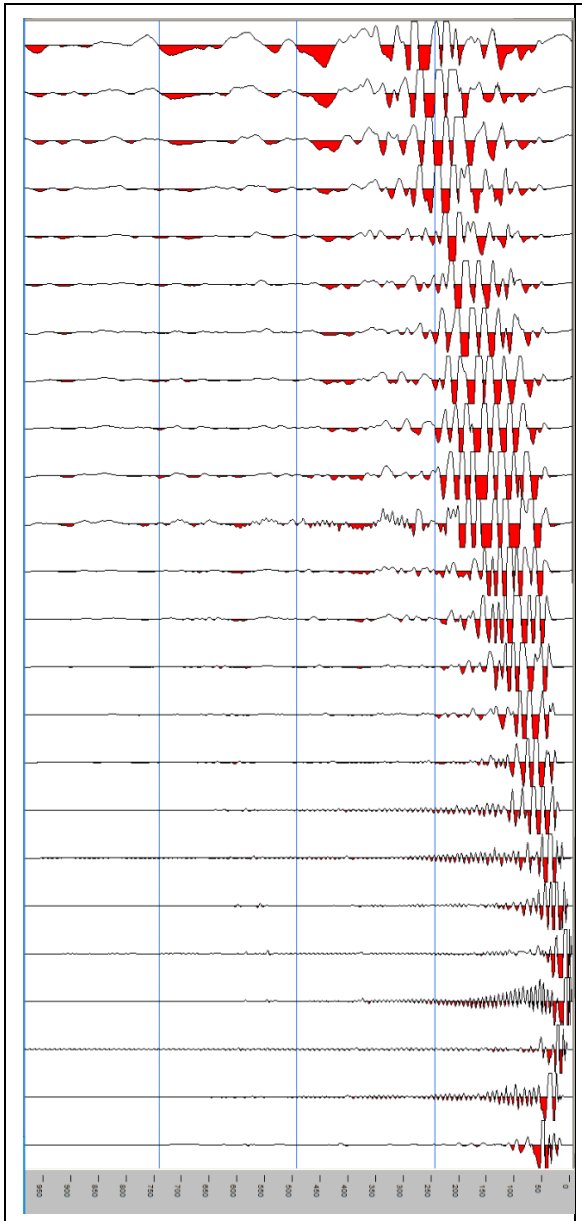
SP1



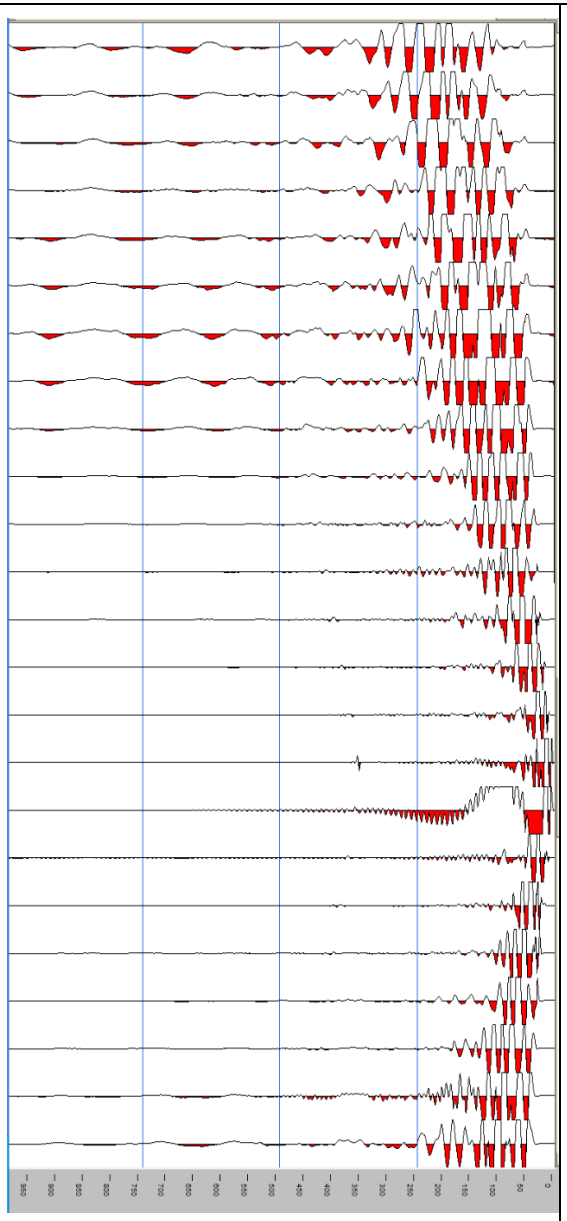
SP2



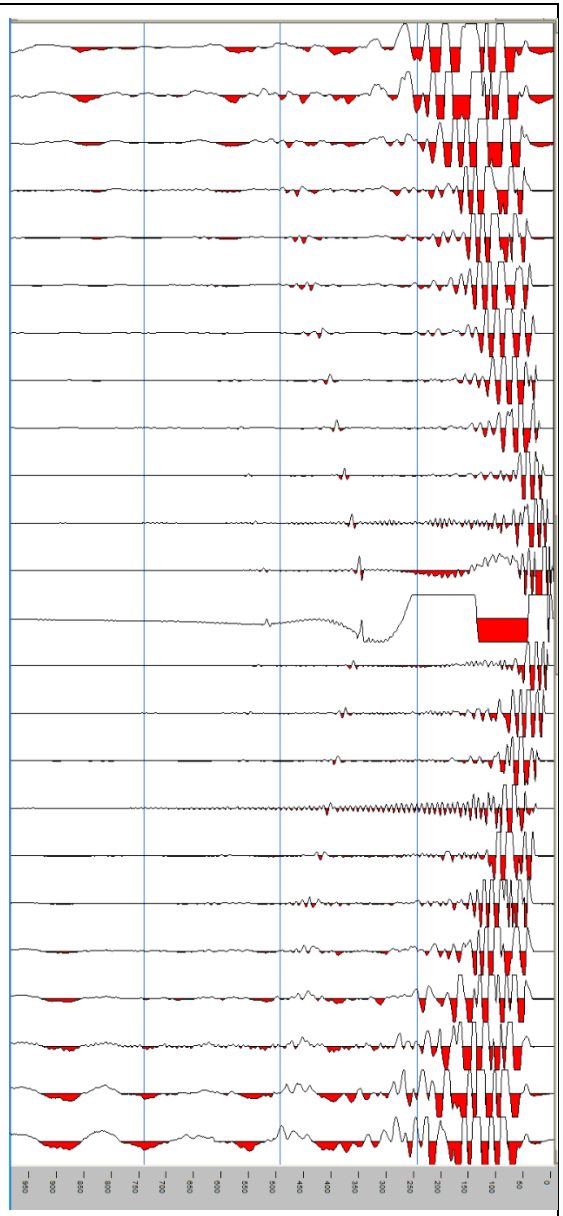
SP3



SP6



SP5



SP4

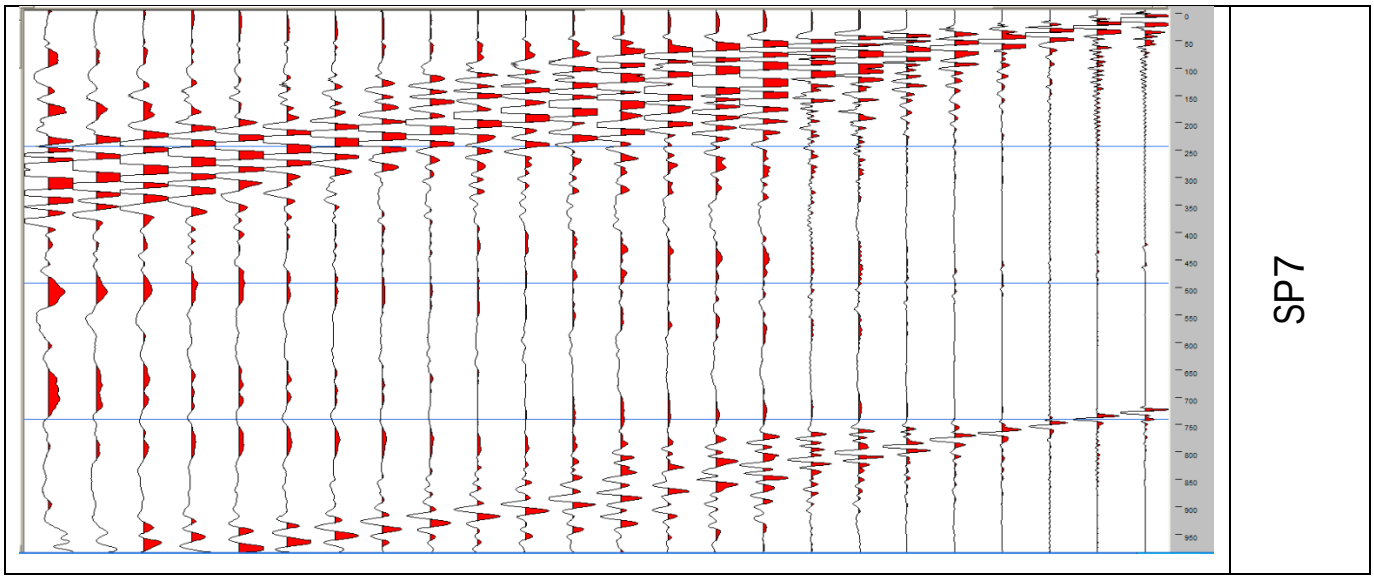
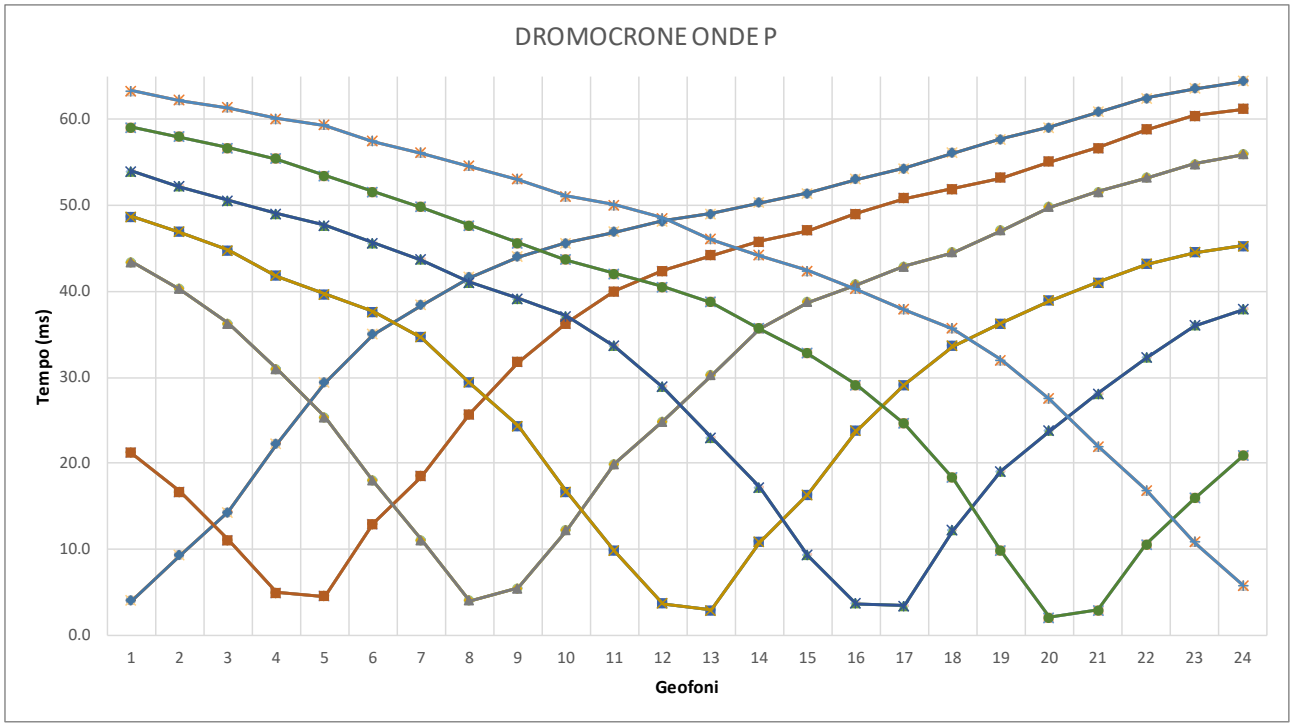
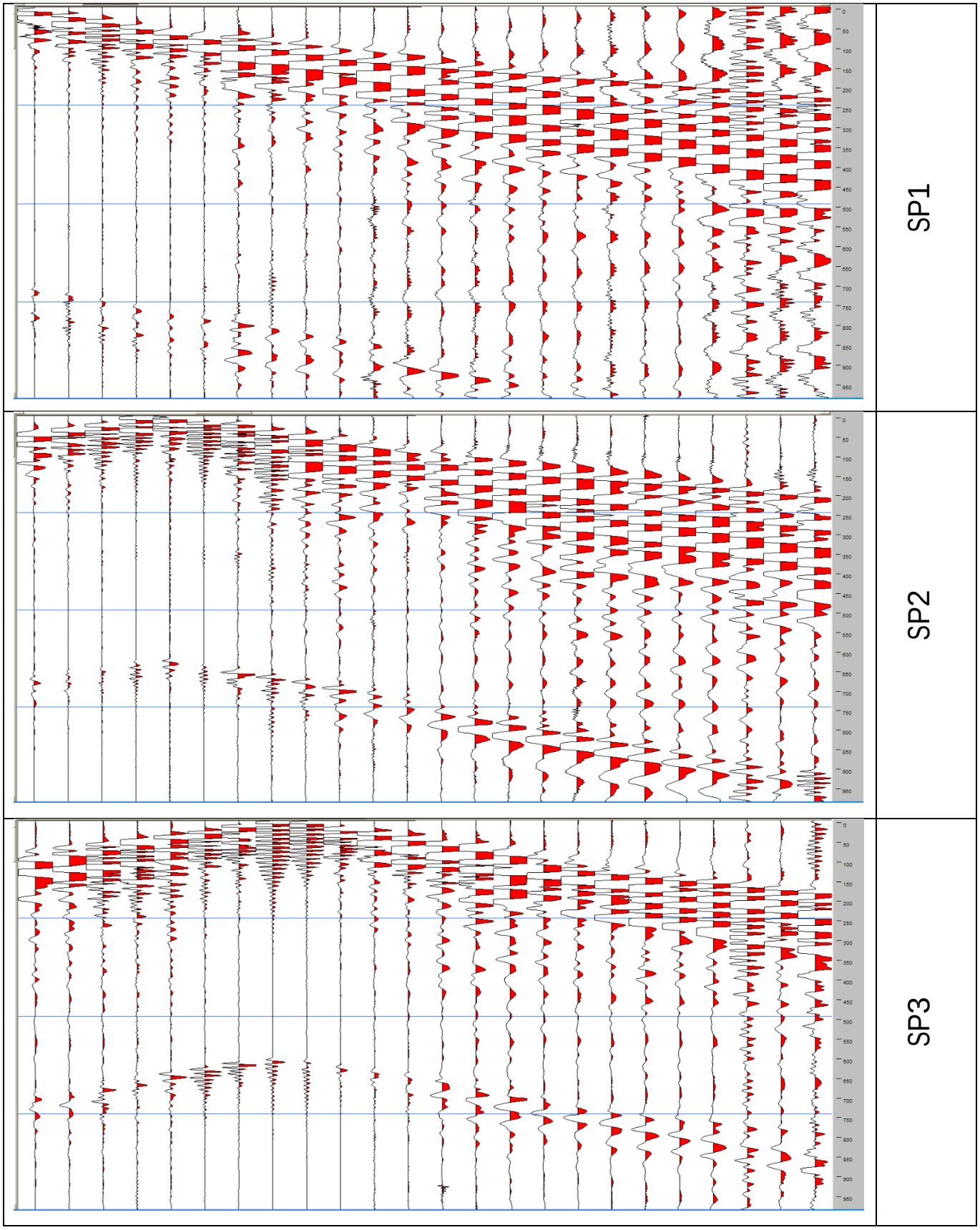


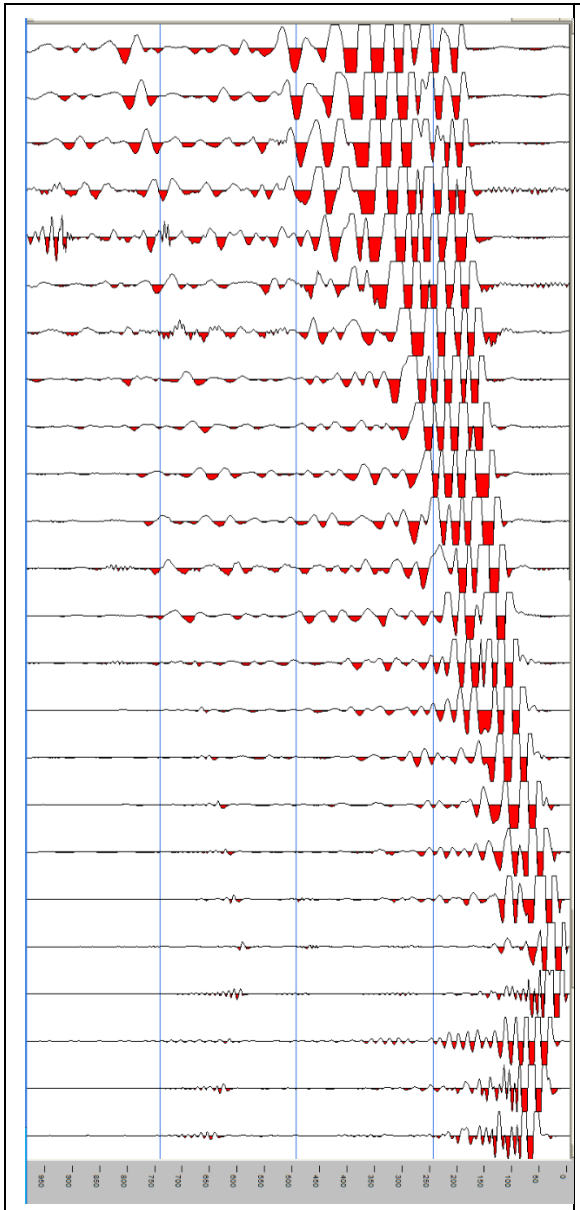
Tabella geometria e tempi onde P

ONDE P				GEOFONI																							
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	Quota (m)
S1	Progressiva (m)	1.25	PS1	4.0	9.3	14.3	22.2	29.4	35.0	38.4	41.6	44.0	45.6	46.9	48.2	49.0	50.3	51.4	53.0	54.3	56.1	57.7	59.1	60.9	62.5	63.6	64.4	Tempo (ms)
	Quota (m)	145.4																										
S2	Progressiva (m)	11.25	PS2	21.2	16.7	11.1	5.0	4.5	13.0	18.5	25.7	31.8	36.3	40.0	42.4	44.2	45.8	47.1	49.0	50.8	51.9	53.2	55.1	56.7	58.8	60.4	61.2	
	Quota (m)	145.4																										
S3	Progressiva (m)	21.25	PS3	43.4	40.3	36.3	31.0	25.4	18.0	11.1	4.0	5.5	12.2	19.9	24.9	30.2	35.7	38.7	40.8	42.9	44.5	47.1	49.8	51.6	53.2	54.8	55.9	
	Quota (m)	145.4																										
S4	Progressiva (m)	31.25	PS4	48.7	46.9	44.8	41.8	39.7	37.6	34.7	29.4	24.4	16.7	9.8	3.7	2.9	10.8	16.4	23.8	29.1	33.6	36.3	38.9	41.0	43.2	44.5	45.3	
	Quota (m)	145.4																										
S5	Progressiva (m)	41.25	PS5	54.0	52.2	50.6	49.0	47.7	45.6	43.7	41.0	39.2	37.1	33.6	28.9	23.0	17.2	9.3	3.7	3.4	12.2	19.1	23.8	28.1	32.3	36.0	37.9	
	Quota (m)	145.4																										
S6	Progressiva (m)	51.25	PS6	59.1	58.0	56.7	55.4	53.5	51.6	49.8	47.7	45.6	43.7	42.1	40.5	38.7	35.7	32.8	29.1	24.6	18.3	9.8	2.1	2.9	10.6	15.9	20.9	
	Quota (m)	145.4																										
S7	Progressiva (m)	61.25	PS7	63.3	62.2	61.4	60.1	59.3	57.5	56.1	54.6	53.0	51.1	50.1	48.5	46.1	44.2	42.4	40.3	37.9	35.7	32.0	27.5	22.0	16.9	10.8	5.8	
	Quota (m)	145.4																										

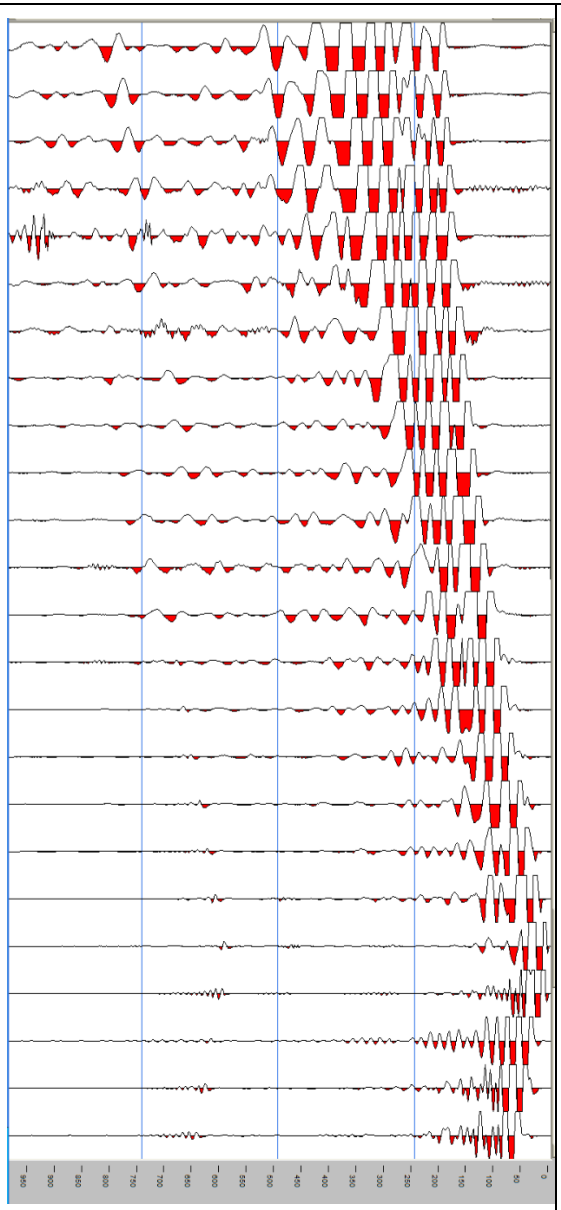


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

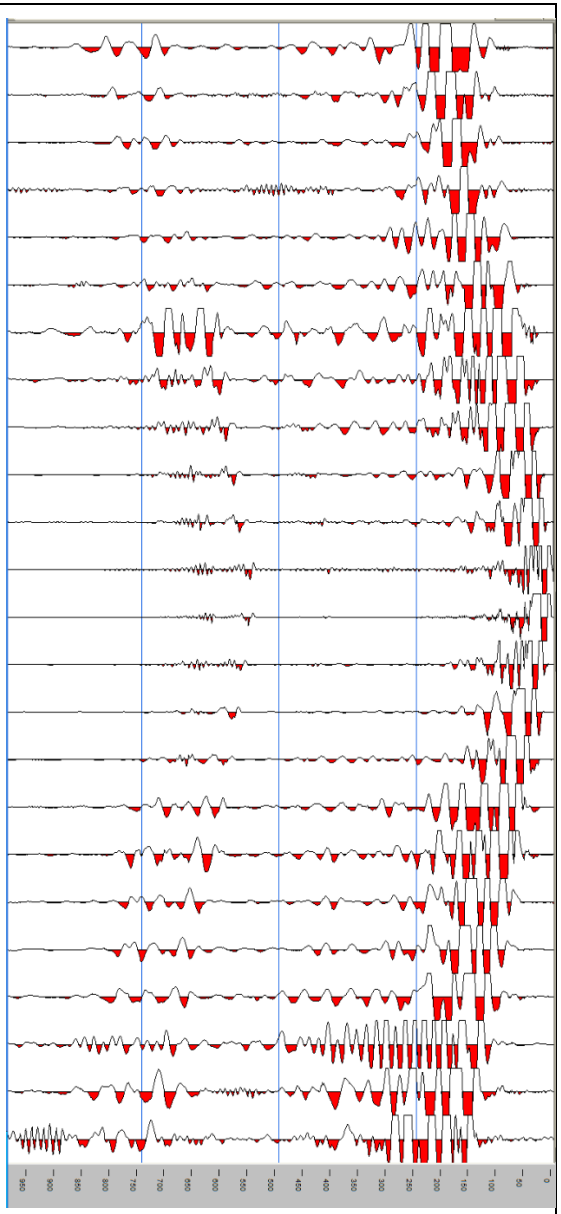




SP6



SP5



SP4

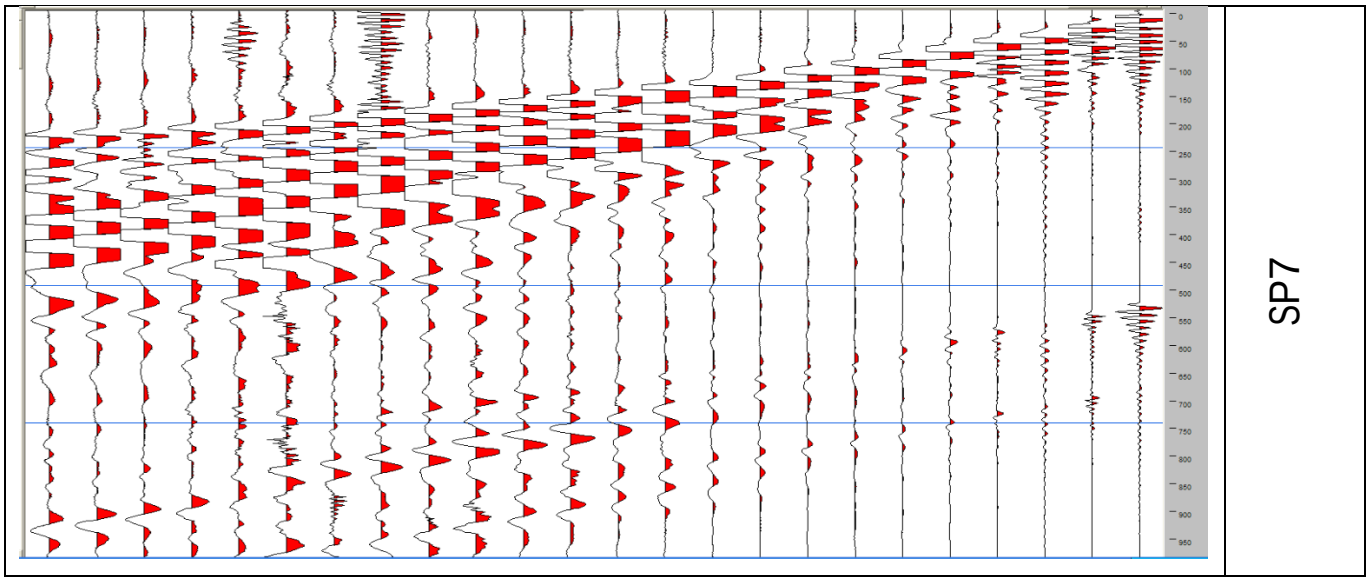
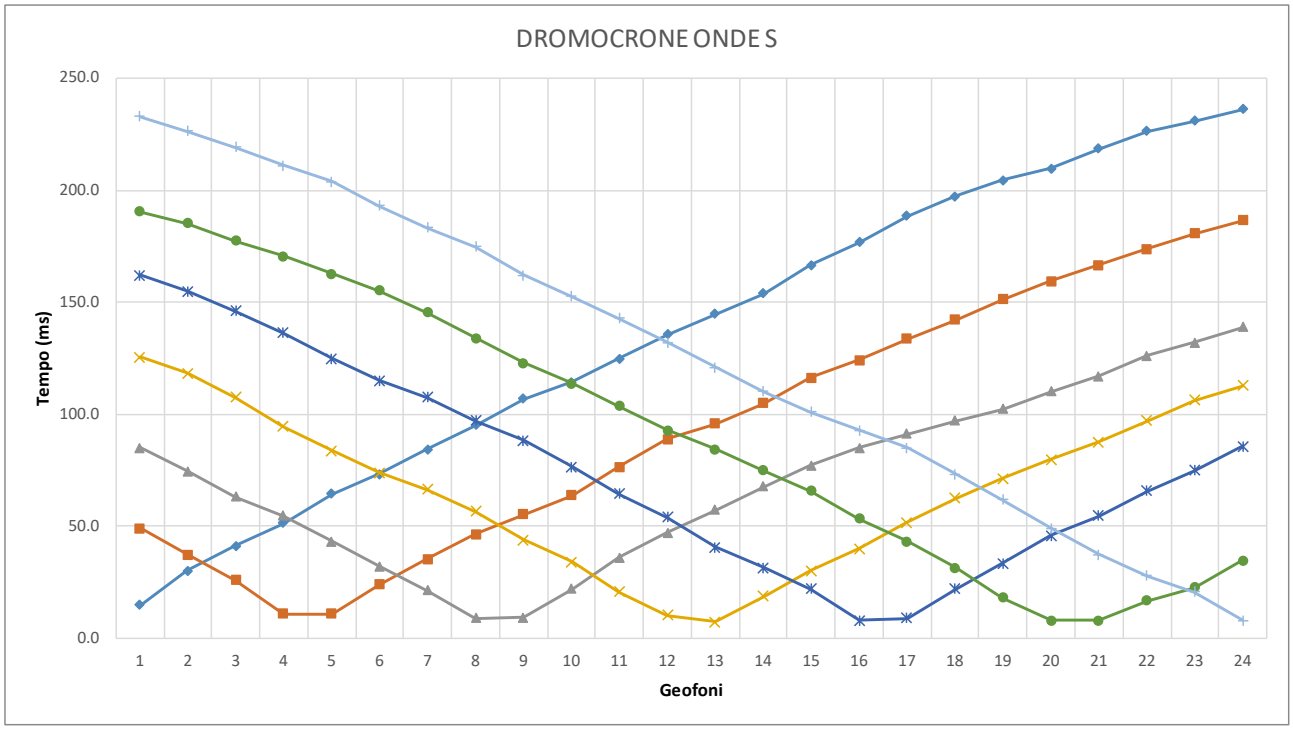


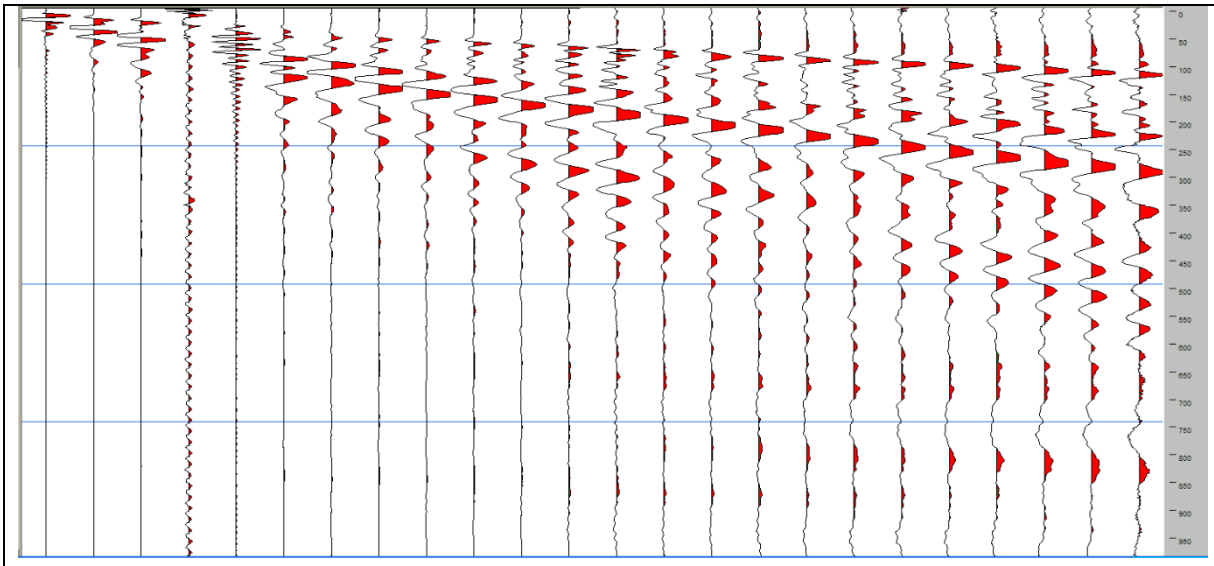
Tabella geometria e tempi onde S

ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	Quota (m)
S1	Progressiva (m)	1.25	PS1	14.8	30.1	41.3	51.3	64.5	73.2	84.4	95.0	107.0	114.3	124.9	135.5	144.7	154.0	166.6	176.6	188.5	197.1	204.4	209.7	218.3	226.3	230.9	236.2	Tempo (ms)
	Quota (m)	145.4																										
S2	Progressiva (m)	11.25	PS2	49.3	37.4	26.1	10.9	10.9	24.1	35.4	46.6	55.3	63.9	76.5	89.1	95.7	105.0	116.2	124.2	133.5	142.1	151.4	159.3	166.6	173.9	180.5	186.5	
	Quota (m)	145.4																										
S3	Progressiva (m)	21.25	PS3	85.1	74.5	63.2	54.6	43.3	32.1	21.5	8.9	9.5	22.1	36.0	47.3	57.3	67.9	77.1	85.1	91.1	97.0	102.3	110.3	116.9	126.2	132.1	138.8	
	Quota (m)	145.4																										
S4	Progressiva (m)	31.25	PS4	125.5	118.2	107.6	94.4	83.8	73.8	66.5	56.6	44.0	34.1	20.8	10.2	7.5	18.8	30.1	40.0	51.9	62.6	71.2	79.8	87.7	97.0	106.3	112.9	
	Quota (m)	145.4																										
S5	Progressiva (m)	41.25	PS5	162.0	154.7	146.1	136.1	124.9	114.9	107.6	97.0	88.4	76.5	64.5	53.9	40.7	31.4	22.1	8.2	8.9	22.1	33.4	46.0	54.6	65.9	75.1	85.8	
	Quota (m)	145.4																										
S6	Progressiva (m)	51.25	PS6	190.5	185.2	177.2	170.6	162.6	155.3	145.4	134.1	122.9	113.6	103.6	93.0	84.4	75.1	65.9	53.3	43.3	31.4	18.1	8.2	8.2	16.8	22.8	34.7	
	Quota (m)	145.4																										
S7	Progressiva (m)	61.25	PS7	232.9	226.3	219.0	211.0	203.7	193.1	183.2	174.6	162.0	152.7	142.8	132.1	120.9	110.3	101.0	93.0	85.1	73.2	61.9	49.3	37.4	28.1	20.8	8.2	
	Quota (m)	145.4																										

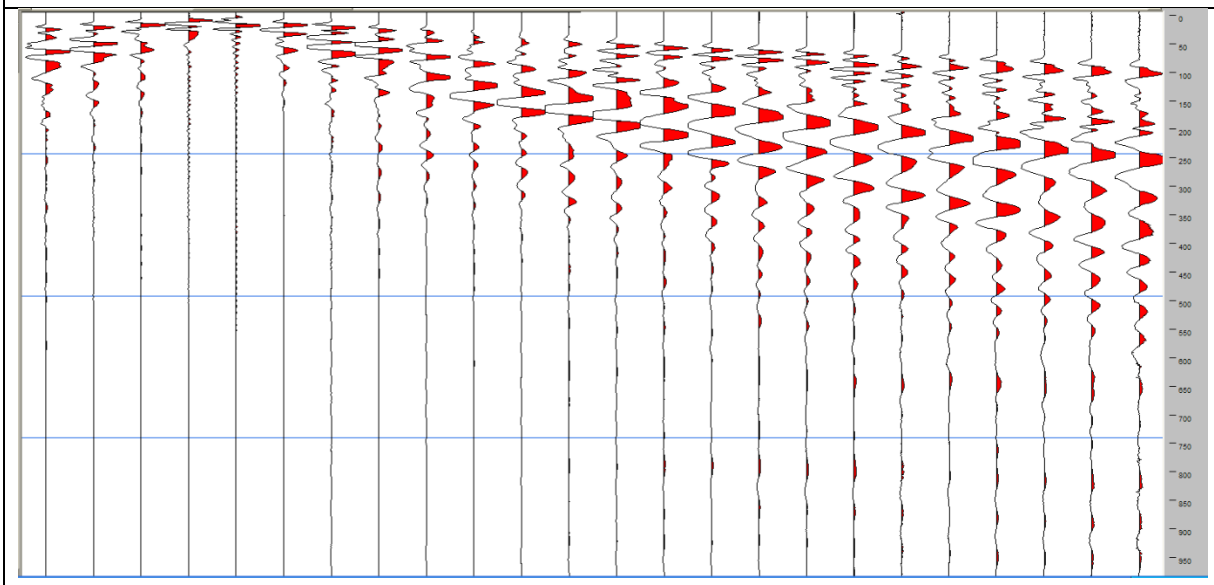


PROFILO SISMICO G

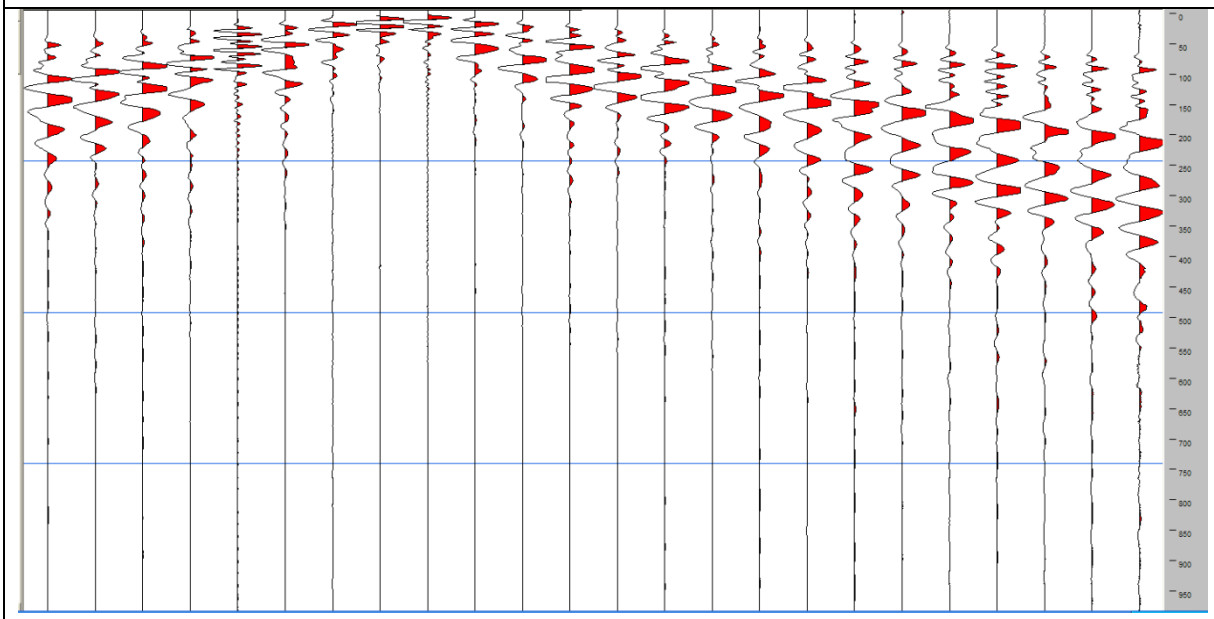
Sismogrammi onde P



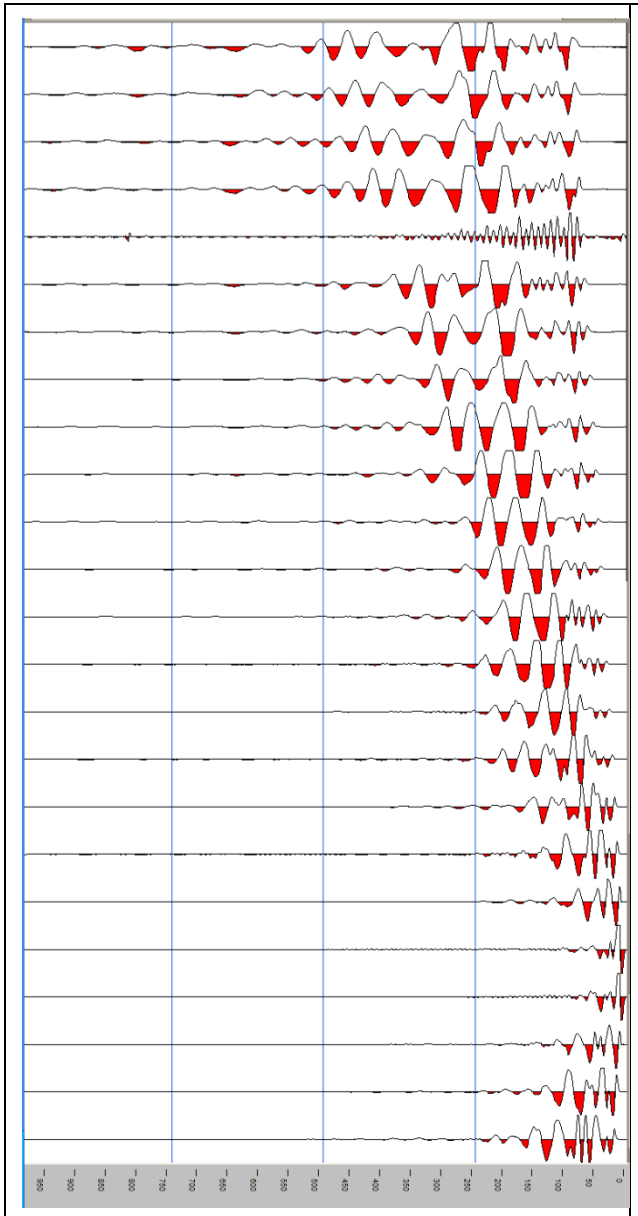
SP1



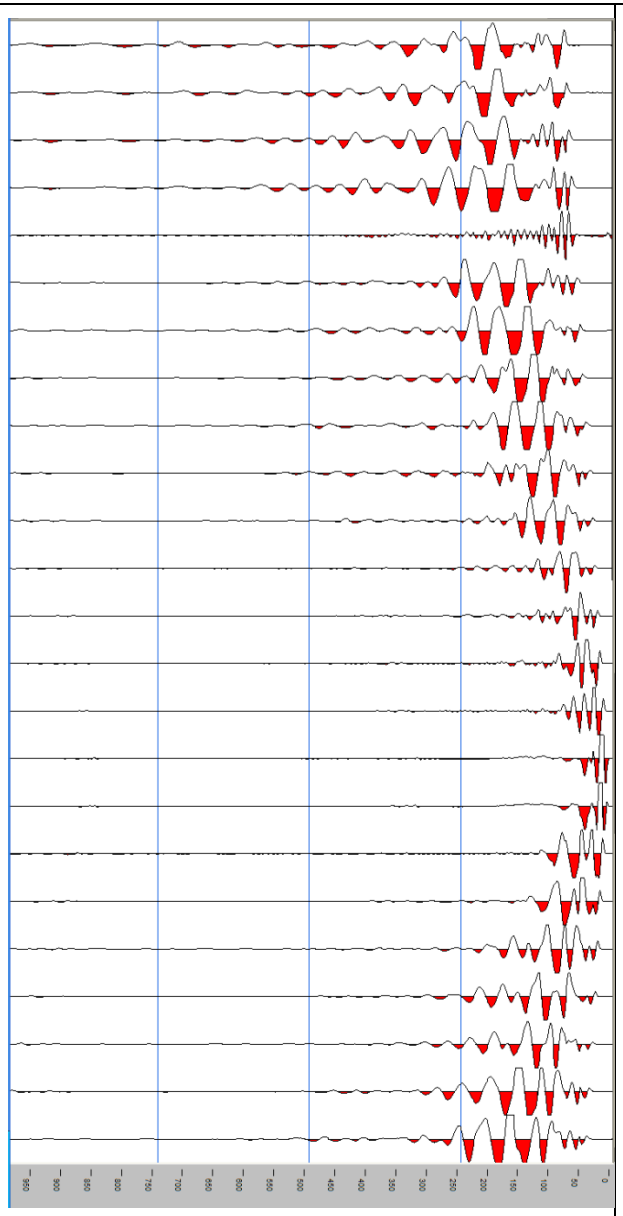
SP2



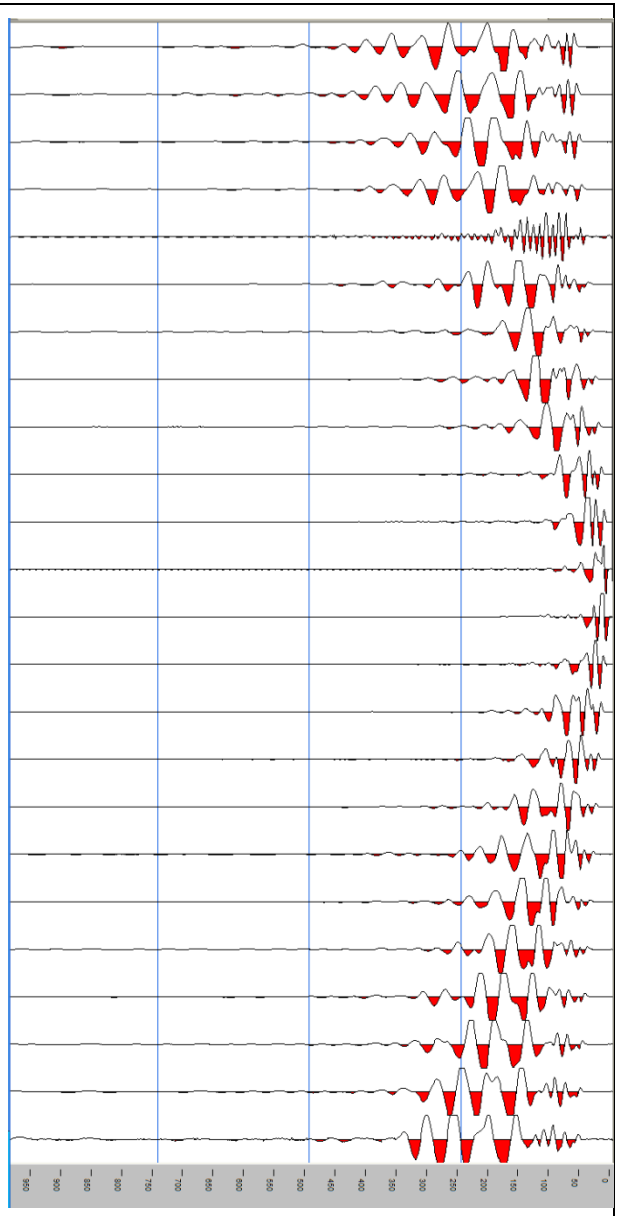
SP3



SP6



SP5



SP4

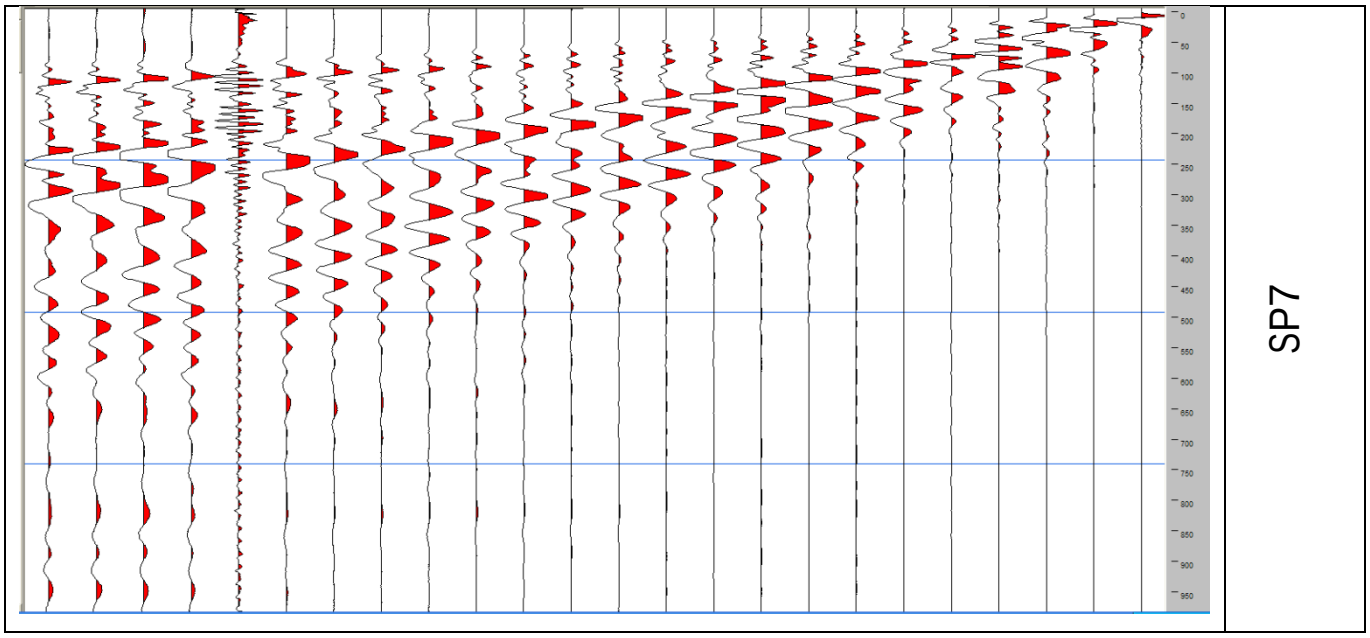
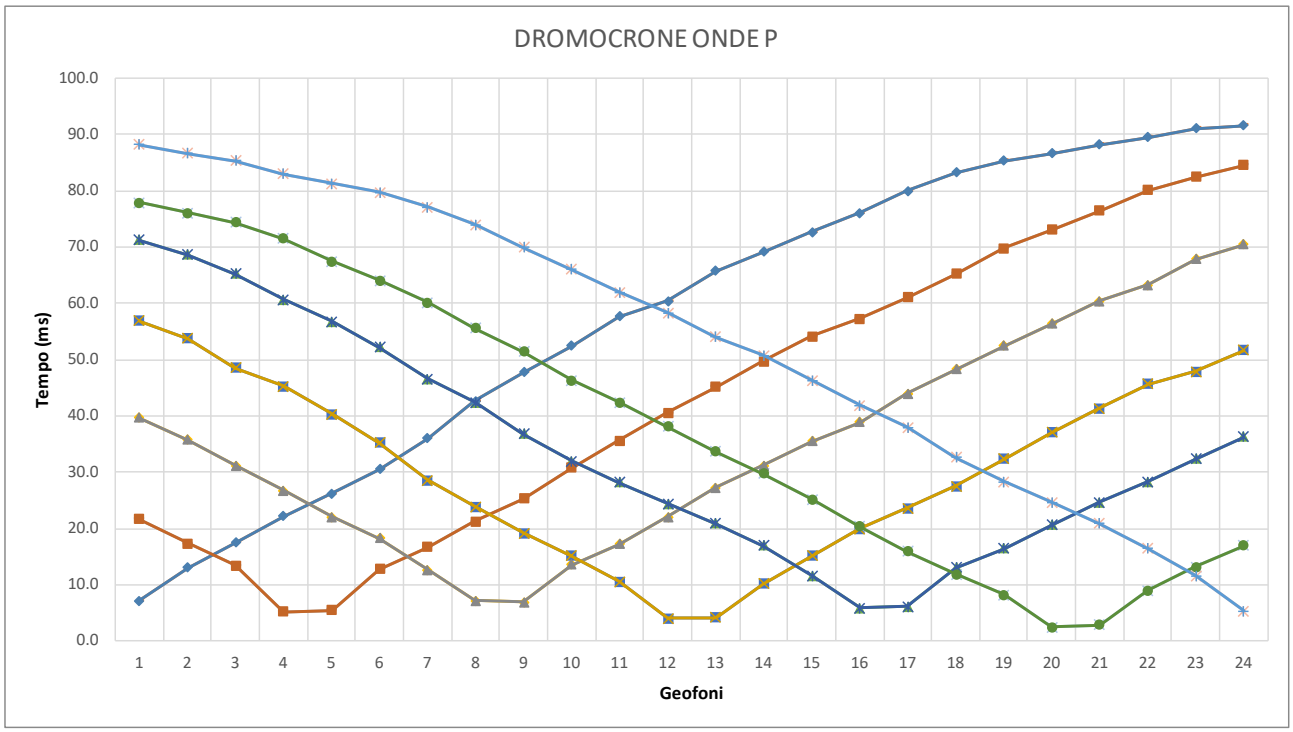
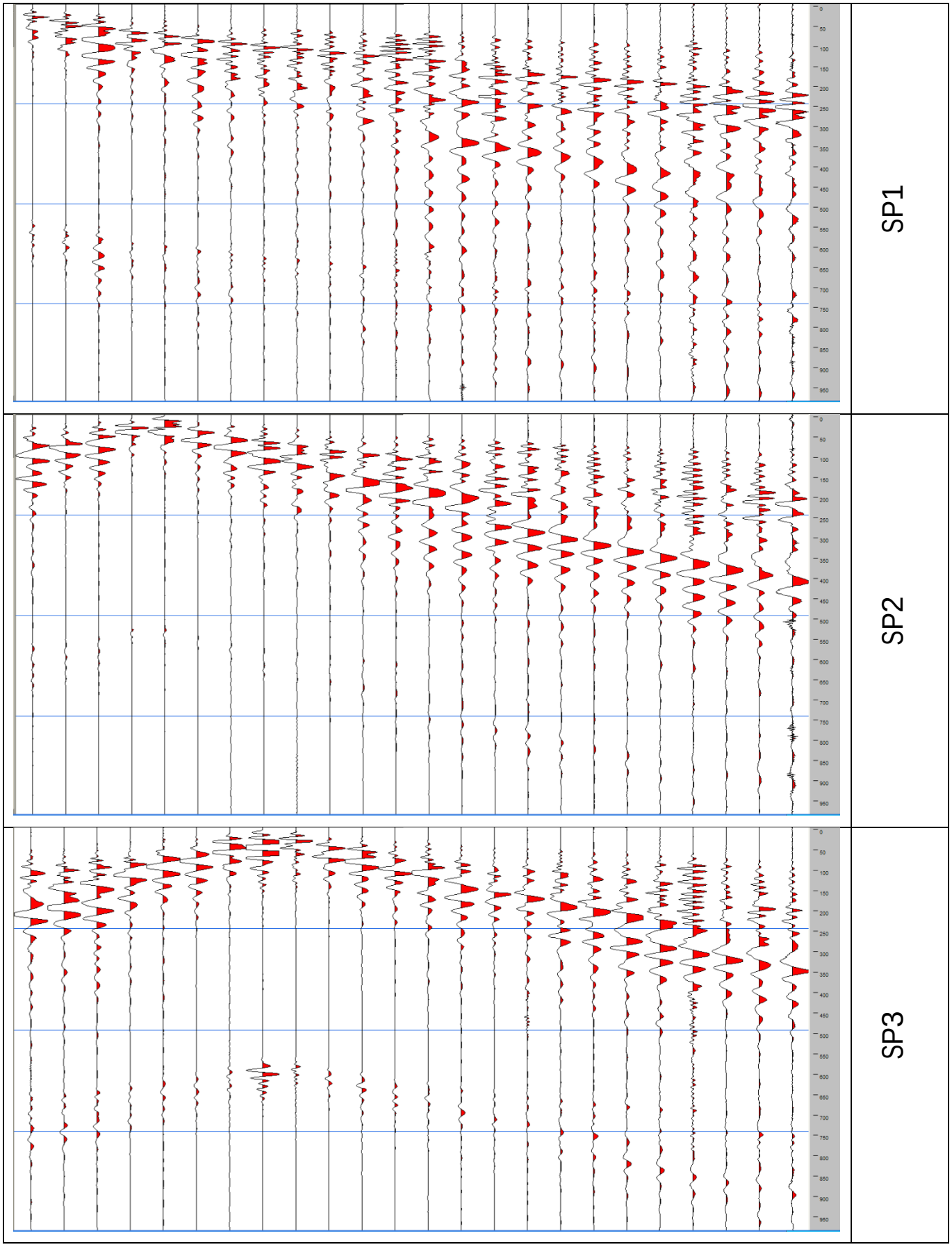


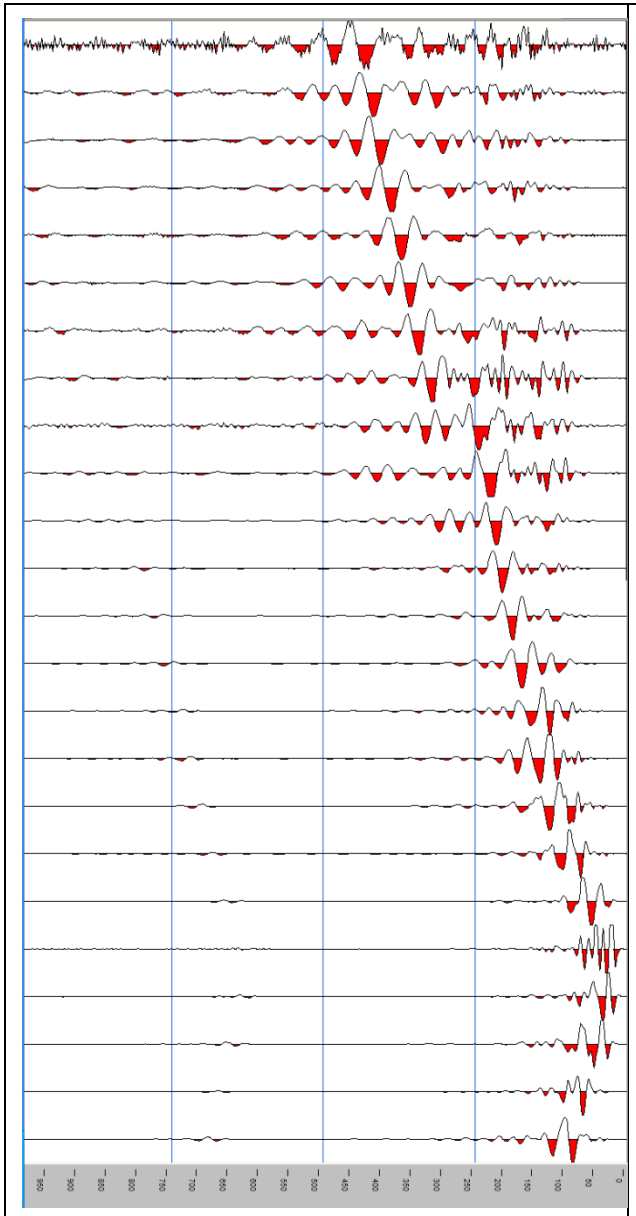
Tabella geometria e tempi onde P

ONDE P				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	Quota (m)
S1	Progressiva (m)	1.25	PS1	7.1	13.0	17.5	22.2	26.2	30.5	36.0	42.6	47.7	52.4	57.7	60.4	65.7	69.1	72.6	76.0	80.0	83.2	85.3	86.6	88.2	89.5	91.1	91.6	Tempo (ms)
	Quota (m)	246.4																										
S2	Progressiva (m)	11.25	PS2	21.7	17.3	13.4	5.2	5.4	12.8	16.7	21.3	25.3	30.8	35.6	40.6	45.1	49.7	54.1	57.3	61.0	65.2	69.8	73.1	76.5	80.1	82.5	84.5	
	Quota (m)	246.4																										
S3	Progressiva (m)	21.25	PS3	39.7	35.7	31.2	26.7	22.0	18.3	12.7	7.1	6.9	13.5	17.2	22.0	27.3	31.2	35.5	38.9	44.0	48.2	52.4	56.4	60.4	63.3	67.8	70.5	
	Quota (m)	246.4																										
S4	Progressiva (m)	31.25	PS4	56.9	53.8	48.5	45.3	40.3	35.2	28.6	23.8	19.1	15.1	10.6	4.0	4.2	10.1	15.1	19.9	23.6	27.5	32.3	37.1	41.3	45.6	47.9	51.6	
	Quota (m)	246.4																										
S5	Progressiva (m)	41.25	PS5	71.2	68.6	65.2	60.7	56.7	52.2	46.6	42.4	36.8	32.0	28.1	24.4	20.9	16.9	11.6	5.8	6.1	13.0	16.4	20.6	24.6	28.3	32.3	36.3	
	Quota (m)	246.4																										
S6	Progressiva (m)	51.25	PS6	77.9	76.0	74.4	71.5	67.5	64.1	60.1	55.6	51.4	46.3	42.4	38.1	33.6	29.7	25.2	20.4	15.9	11.9	8.2	2.4	2.9	9.0	13.2	16.9	
	Quota (m)	246.4																										
S7	Progressiva (m)	61.25	PS7	88.2	86.6	85.3	82.9	81.3	79.7	77.1	73.9	69.9	66.0	62.0	58.3	54.0	50.8	46.3	41.8	37.9	32.6	28.3	24.6	20.9	16.4	11.6	5.3	
	Quota (m)	246.4																										

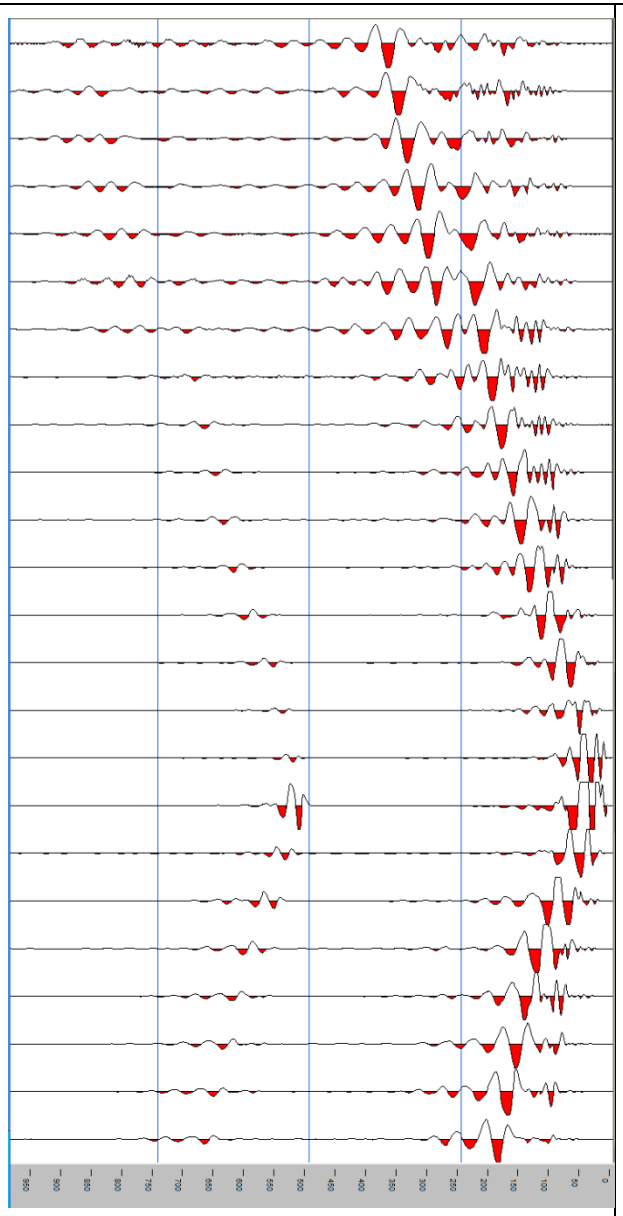


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

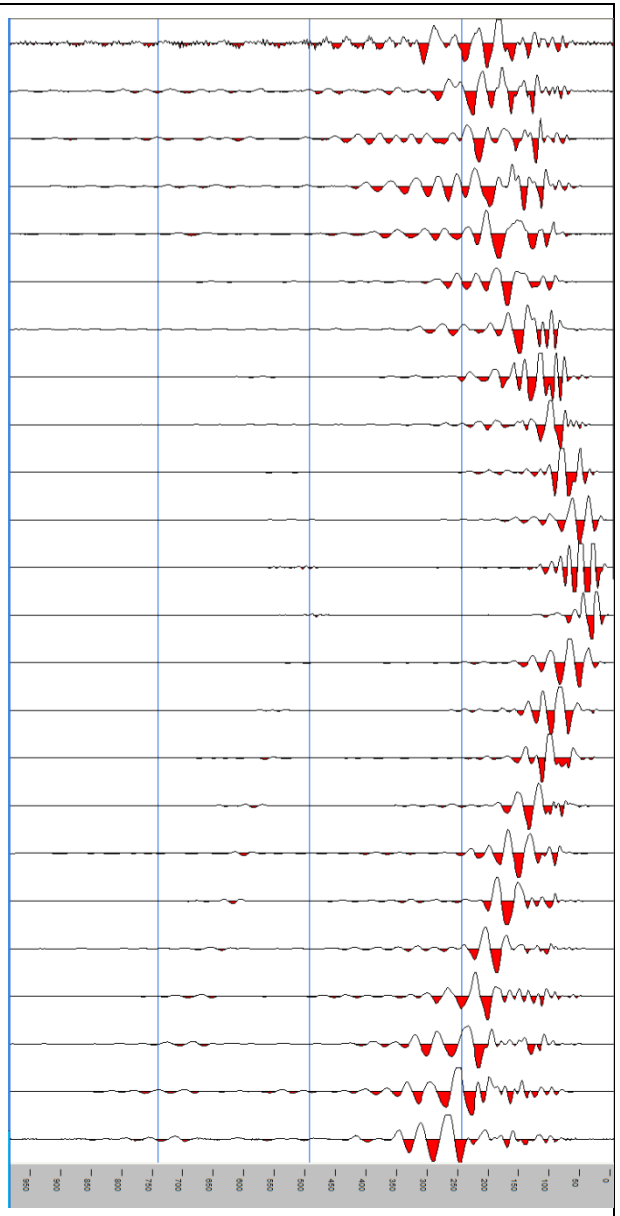




SP6



SP5



SP4

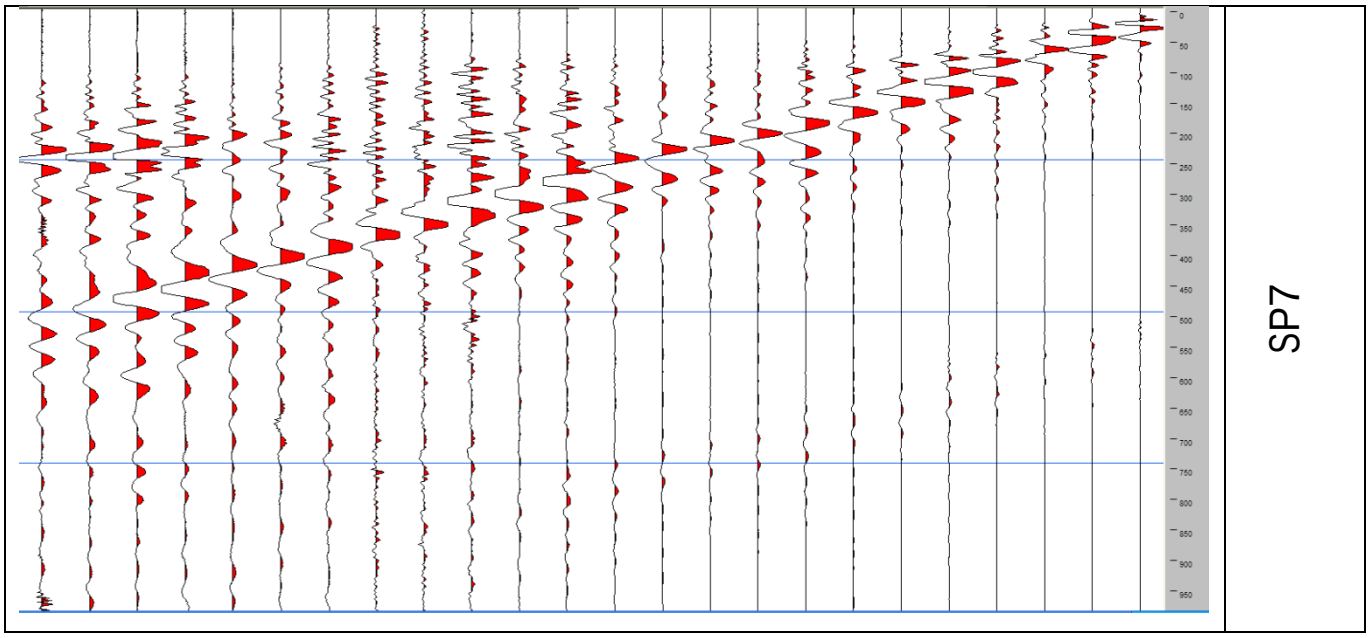
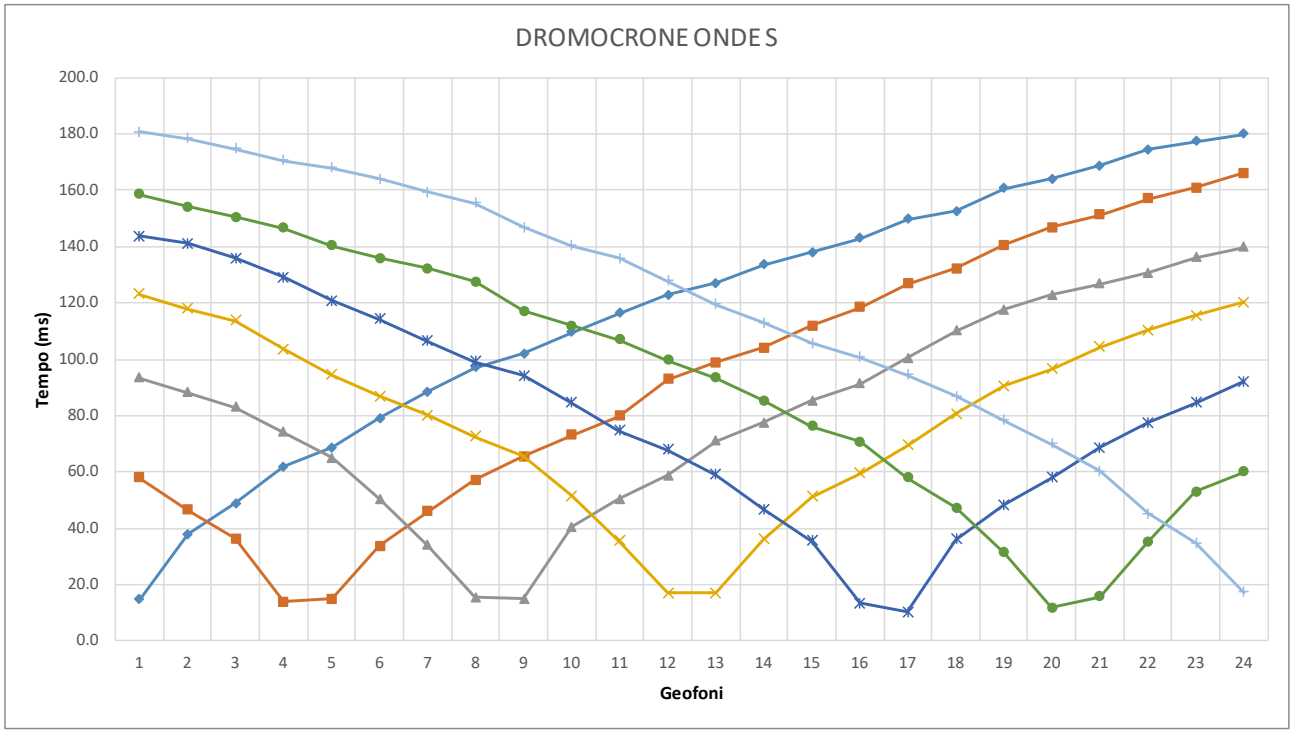


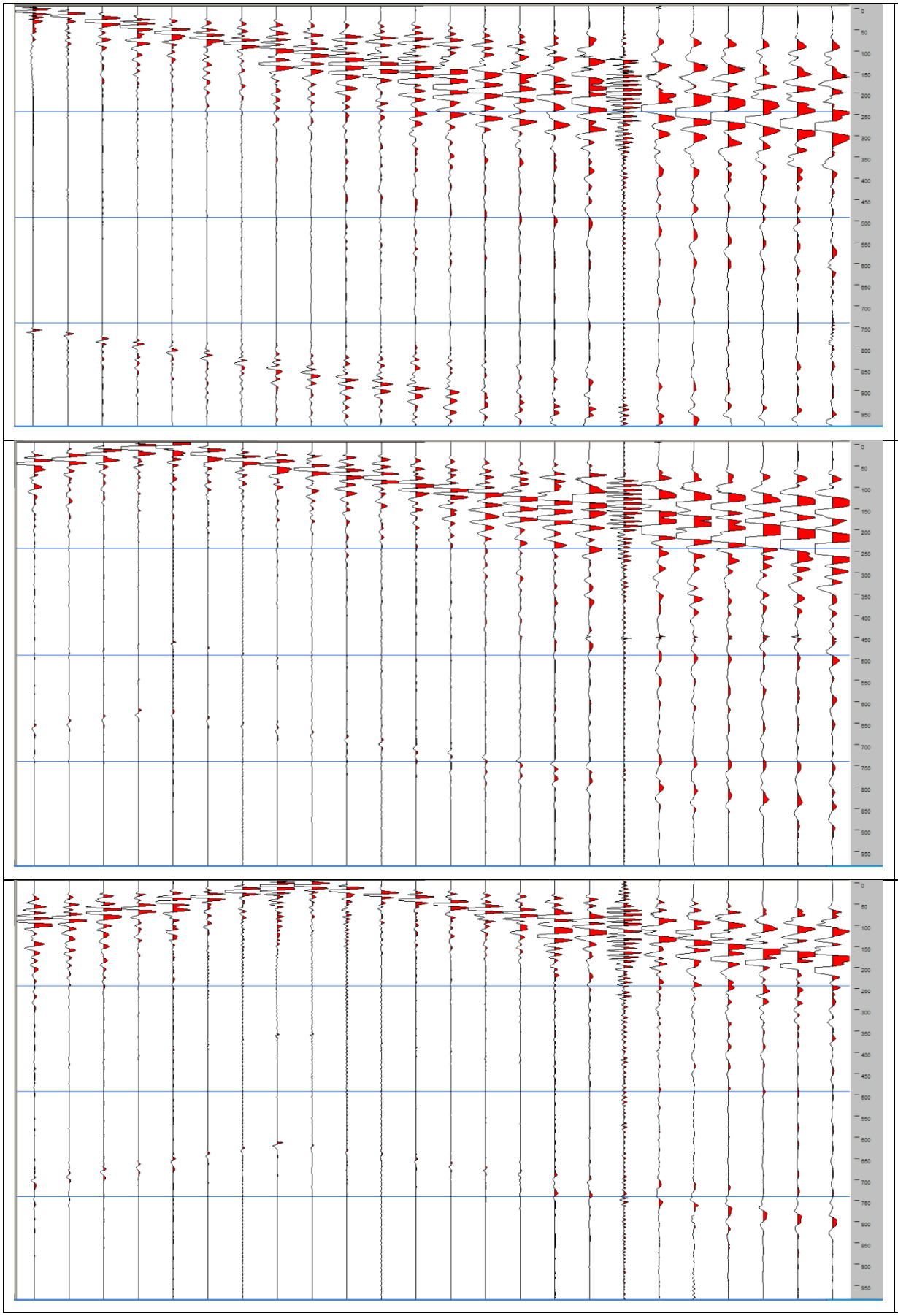
Tabella geometria e tempi onde S

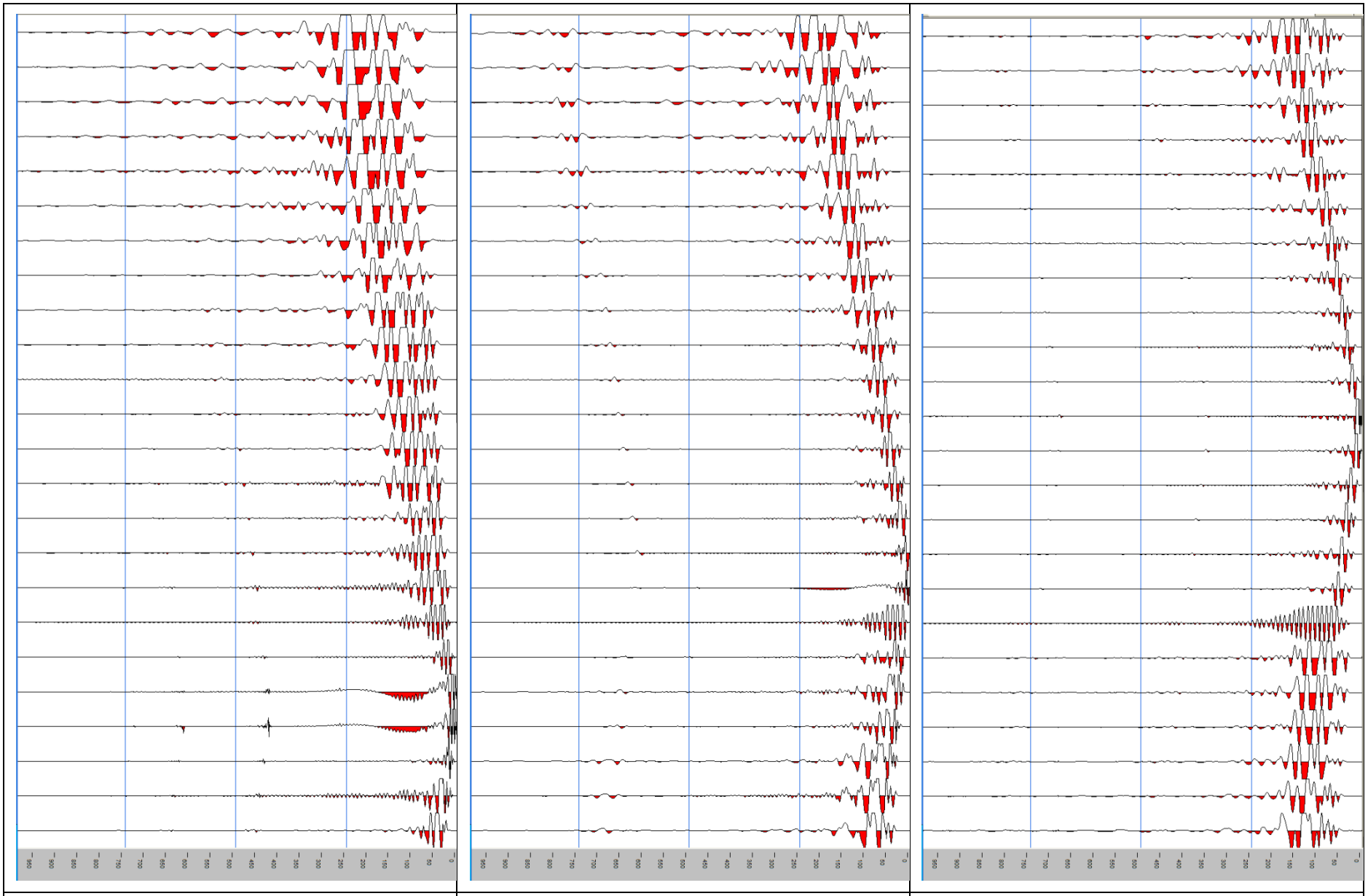
ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	246.4	Quota (m)
S1	Progressiva (m)	1.25	PS1	14.6	38.0	48.8	61.9	68.6	79.0	88.5	96.9	102.0	109.6	116.3	122.7	127.1	133.4	138.0	143.0	149.7	152.5	160.5	164.0	168.8	174.4	177.2	179.9	Tempo (ms)
	Quota (m)	246.4																										
S2	Progressiva (m)	11.25	PS2	57.9	46.4	36.4	13.8	15.0	33.6	46.0	57.1	65.4	73.0	79.8	92.9	98.8	104.0	112.0	118.3	126.7	132.2	140.6	146.9	151.3	156.9	160.9	166.0	
	Quota (m)	246.4																										
S3	Progressiva (m)	21.25	PS3	93.3	88.1	82.9	74.2	65.1	50.3	34.0	15.4	15.0	40.4	50.3	58.7	71.0	77.4	85.3	91.3	100.4	110.0	117.5	122.7	126.7	130.6	136.2	139.8	
	Quota (m)	246.4																										
S4	Progressiva (m)	31.25	PS4	123.1	117.9	113.6	103.6	94.5	86.9	80.2	72.6	65.4	51.5	35.6	16.9	16.9	36.0	51.1	59.5	69.4	80.6	90.5	96.5	104.4	110.4	115.5	120.3	
	Quota (m)	246.4																										
S5	Progressiva (m)	41.25	PS5	143.8	141.0	135.8	129.1	120.7	114.3	106.4	99.2	94.1	84.5	74.6	67.8	59.1	46.8	35.6	13.4	10.2	36.0	48.4	57.9	68.6	77.4	84.5	92.1	
	Quota (m)	246.4																										
S6	Progressiva (m)	51.25	PS6	158.5	154.1	150.5	146.5	140.2	135.8	132.2	127.5	117.1	112.0	106.8	99.6	93.3	85.3	76.2	70.6	57.9	47.2	31.3	11.8	15.8	35.2	53.1	59.9	
	Quota (m)	246.4																										
S7	Progressiva (m)	61.25	PS7	180.7	178.4	174.8	170.4	168.0	164.0	159.3	155.3	146.9	140.2	135.8	127.9	119.5	112.8	105.6	100.8	94.5	86.9	78.2	69.8	60.3	45.2	34.8	17.3	
	Quota (m)	246.4																										



PROFILO SISMICO H

Sismogrammi onde P





SP6	SP5	SP4

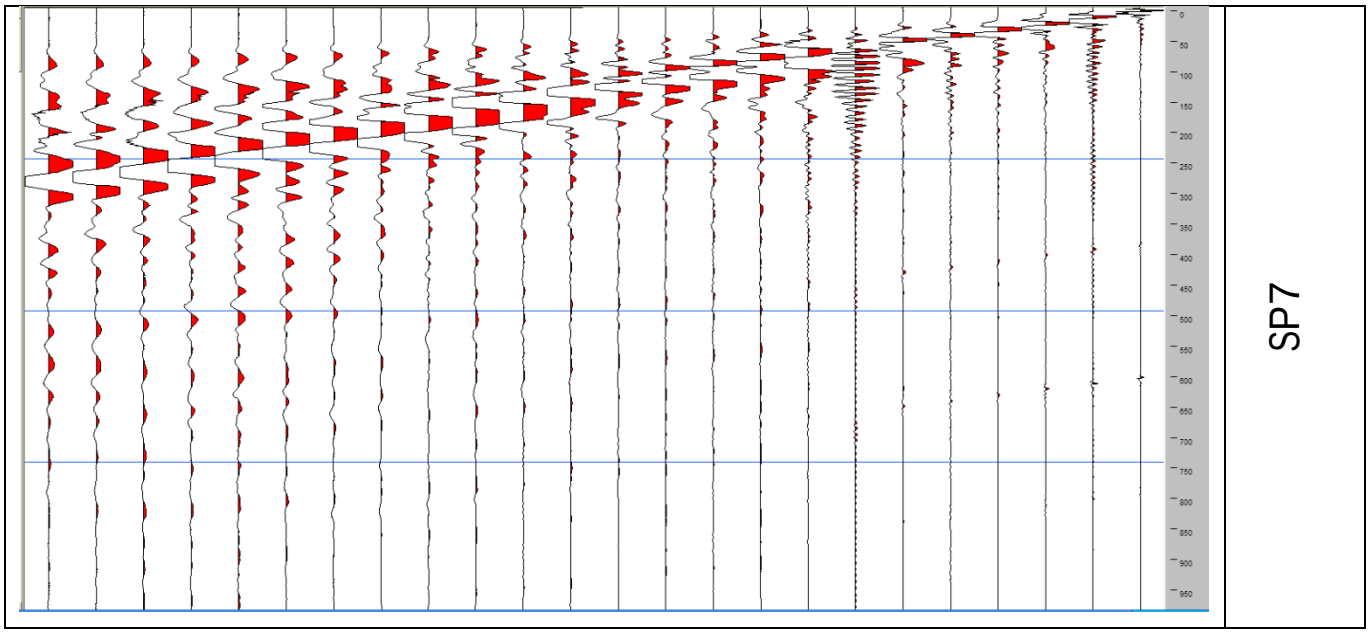
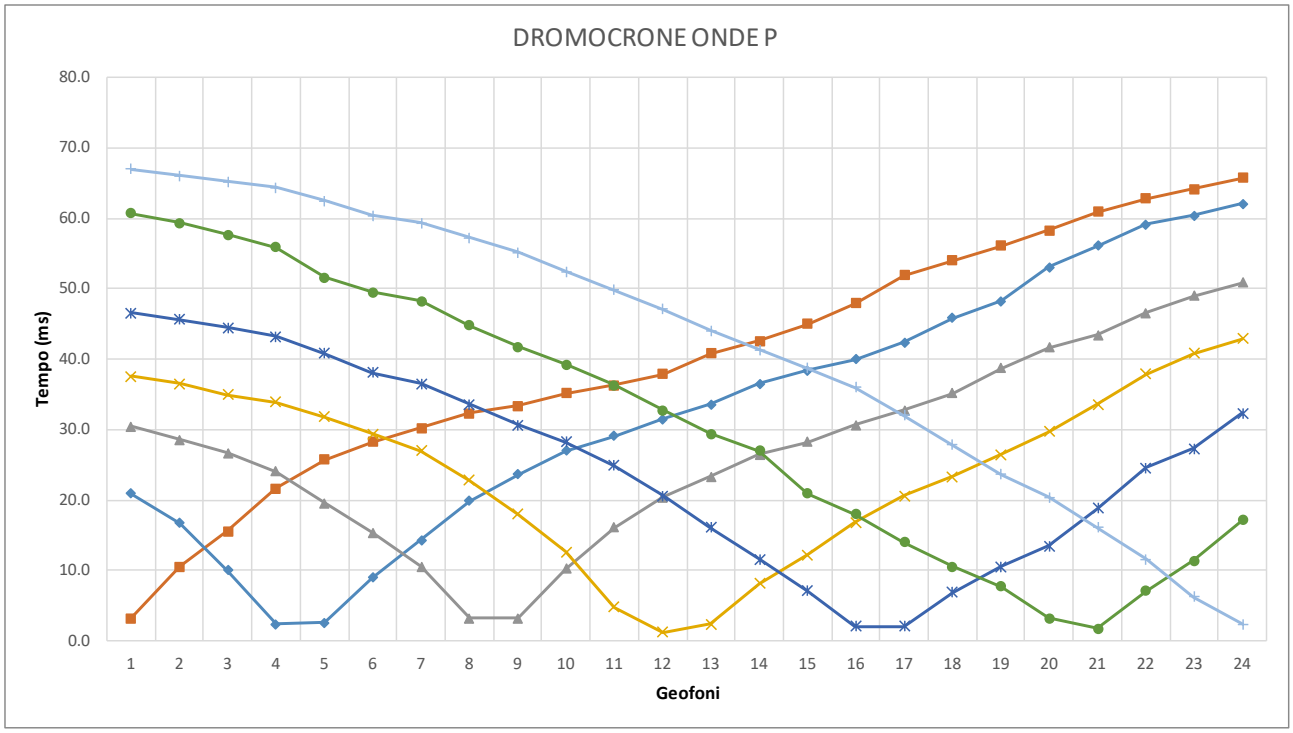
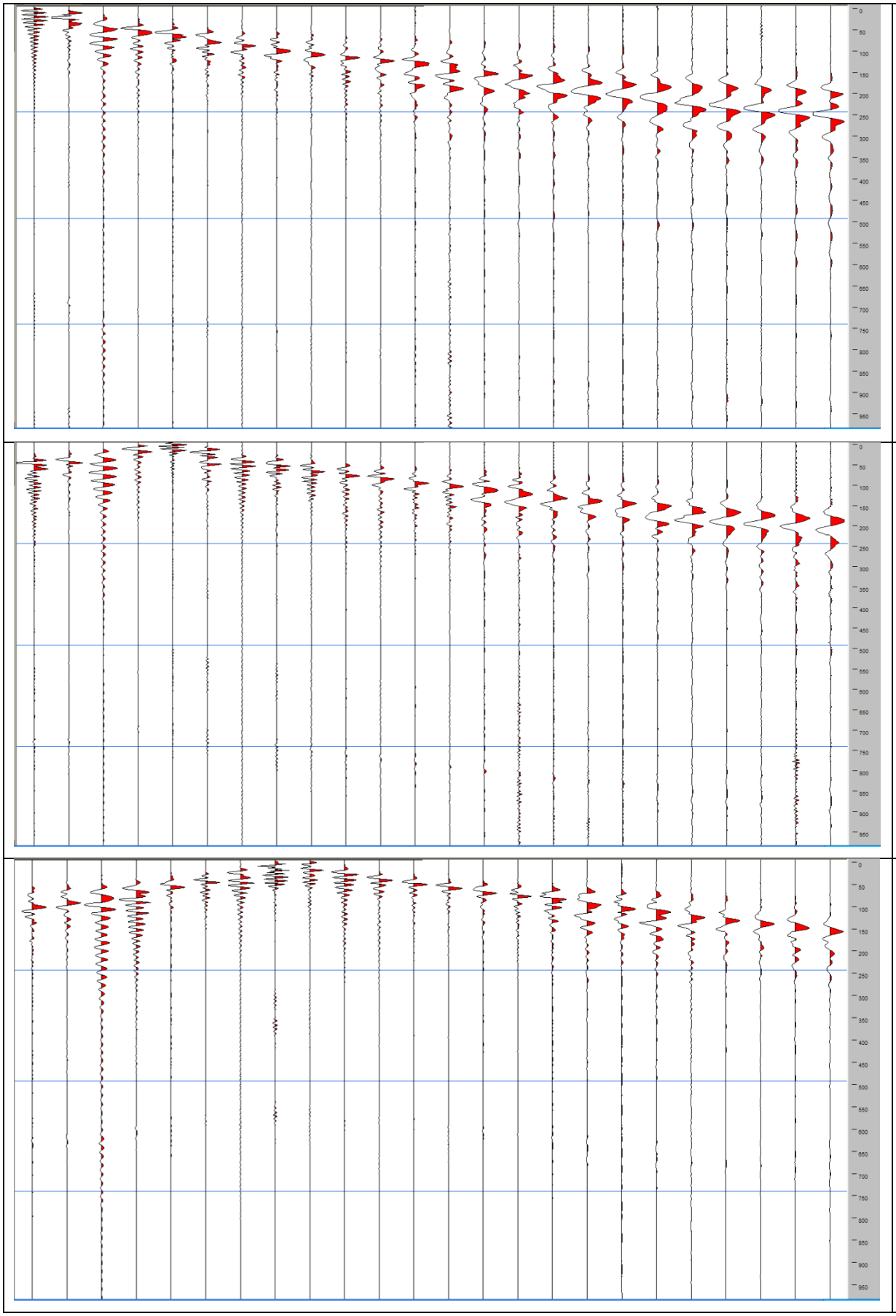


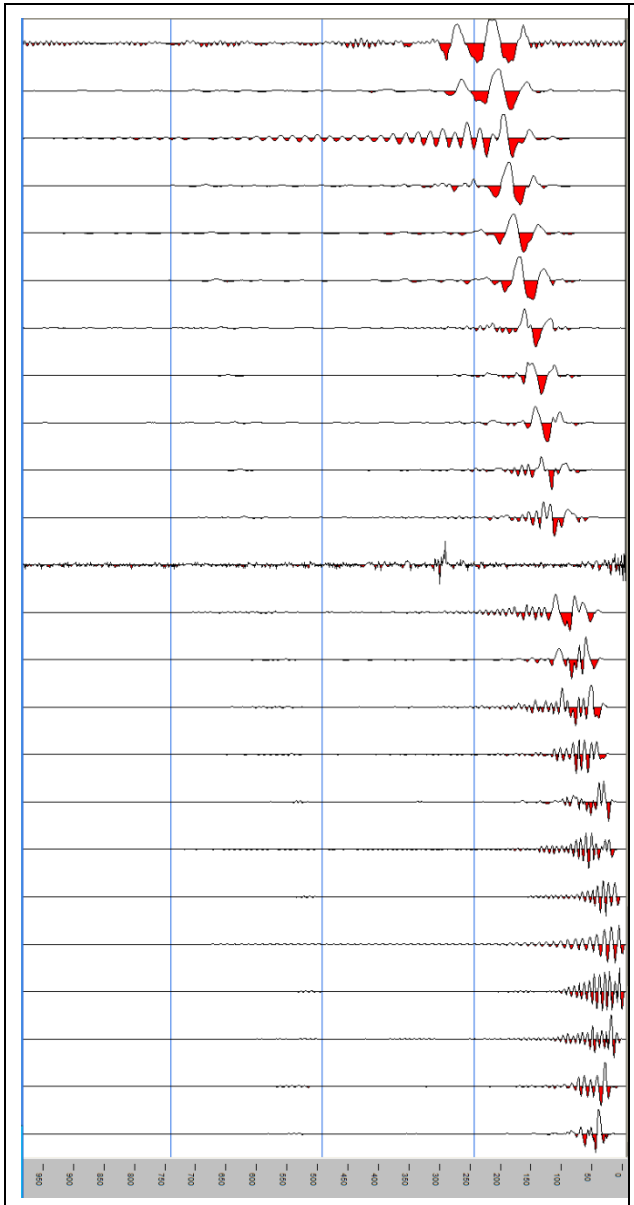
Tabella geometria e tempi onde P

ONDE P				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	3.2	10.6	15.6	21.7	25.7	28.3	30.2	32.3	33.4	35.2	36.3	37.9	40.8	42.6	45.0	47.9	51.9	54.0	56.1	58.3	60.9	62.8	64.1	65.7	Tempo (ms)
	Quota (m)	233.0																										
S2	Progressiva (m)	11.25	PS2	20.9	16.7	10.1	2.4	2.6	9.0	14.3	19.9	23.6	27.0	29.1	31.5	33.6	36.5	38.4	40.0	42.4	45.8	48.2	53.0	56.1	59.1	60.4	62.0	
	Quota (m)	233.0																										
S3	Progressiva (m)	21.25	PS3	30.5	28.6	26.7	24.1	19.6	15.4	10.6	3.2	3.2	10.3	16.1	20.4	23.3	26.5	28.3	30.7	32.8	35.2	38.7	41.6	43.4	46.6	49.0	50.8	
	Quota (m)	233.0																										
S4	Progressiva (m)	31.25	PS4	37.6	36.5	35.0	33.9	31.8	29.4	27.0	22.8	18.0	12.7	4.8	1.3	2.4	8.2	12.2	16.9	20.6	23.3	26.5	29.7	33.6	37.9	40.8	42.9	
	Quota (m)	233.0																										
S5	Progressiva (m)	41.25	PS5	46.6	45.6	44.5	43.2	40.8	38.1	36.5	33.6	30.7	28.3	24.9	20.6	16.1	11.6	7.1	2.1	2.1	6.9	10.6	13.5	18.8	24.6	27.3	32.3	
	Quota (m)	233.0																										
S6	Progressiva (m)	51.25	PS6	60.7	59.3	57.7	55.9	51.6	49.5	48.2	44.8	41.8	39.2	36.3	32.8	29.4	27.0	20.9	18.0	14.0	10.6	7.7	3.2	1.8	7.1	11.4	17.2	
	Quota (m)	233.0																										
S7	Progressiva (m)	61.25	PS7	67.0	66.0	65.2	64.4	62.5	60.4	59.3	57.2	55.1	52.4	49.8	47.1	44.0	41.3	38.7	36.0	32.0	27.8	23.6	20.4	16.1	11.6	6.3	2.4	
	Quota (m)	233.0																										

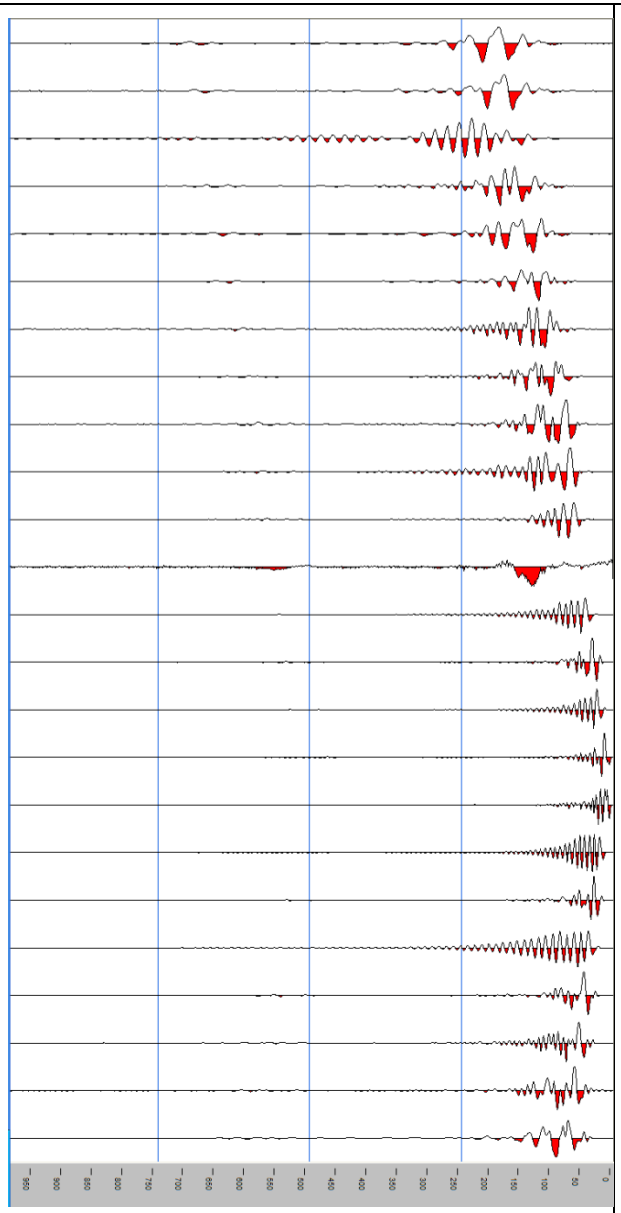


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

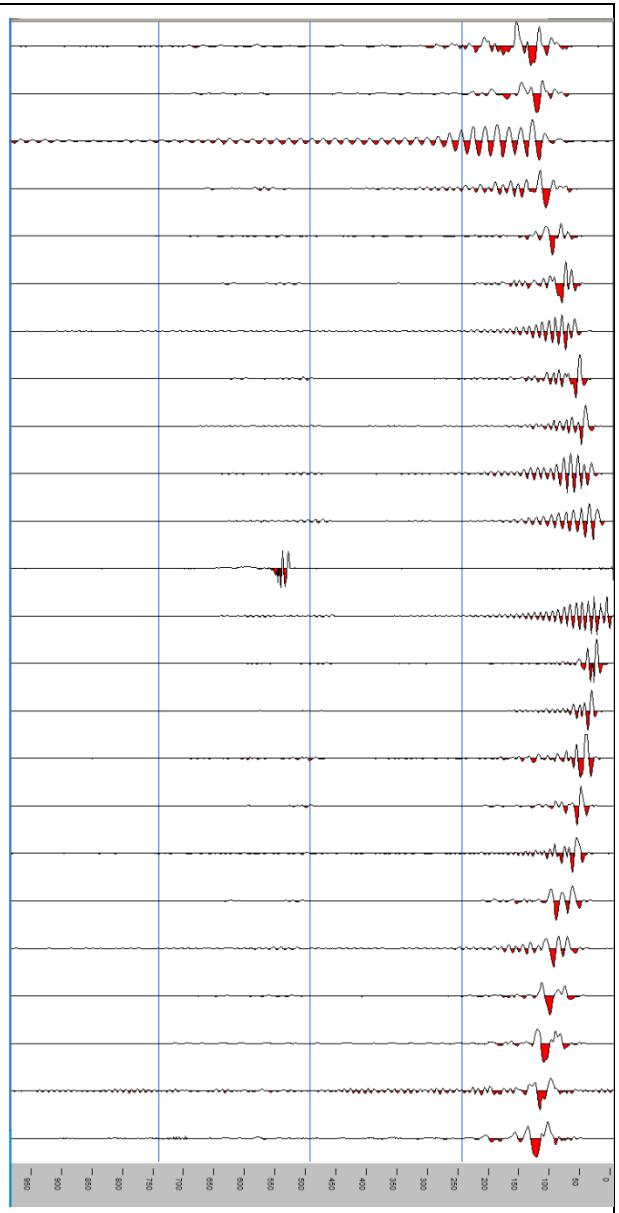




SP6



SP5



SP4

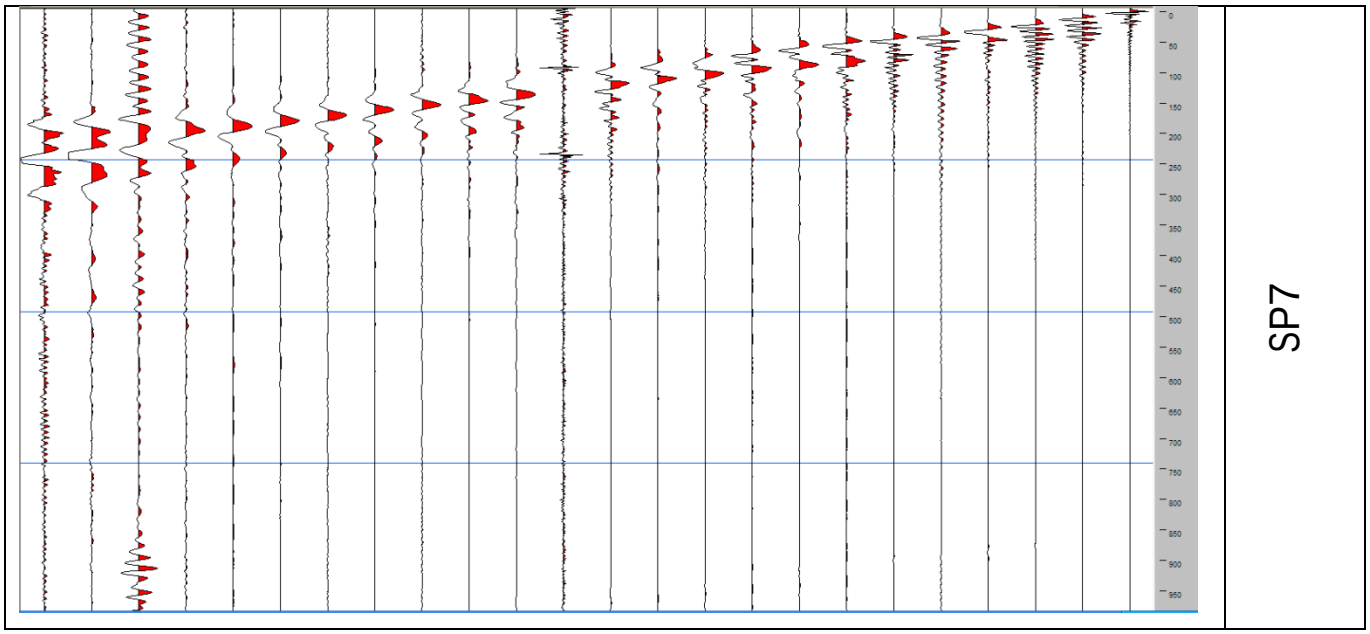
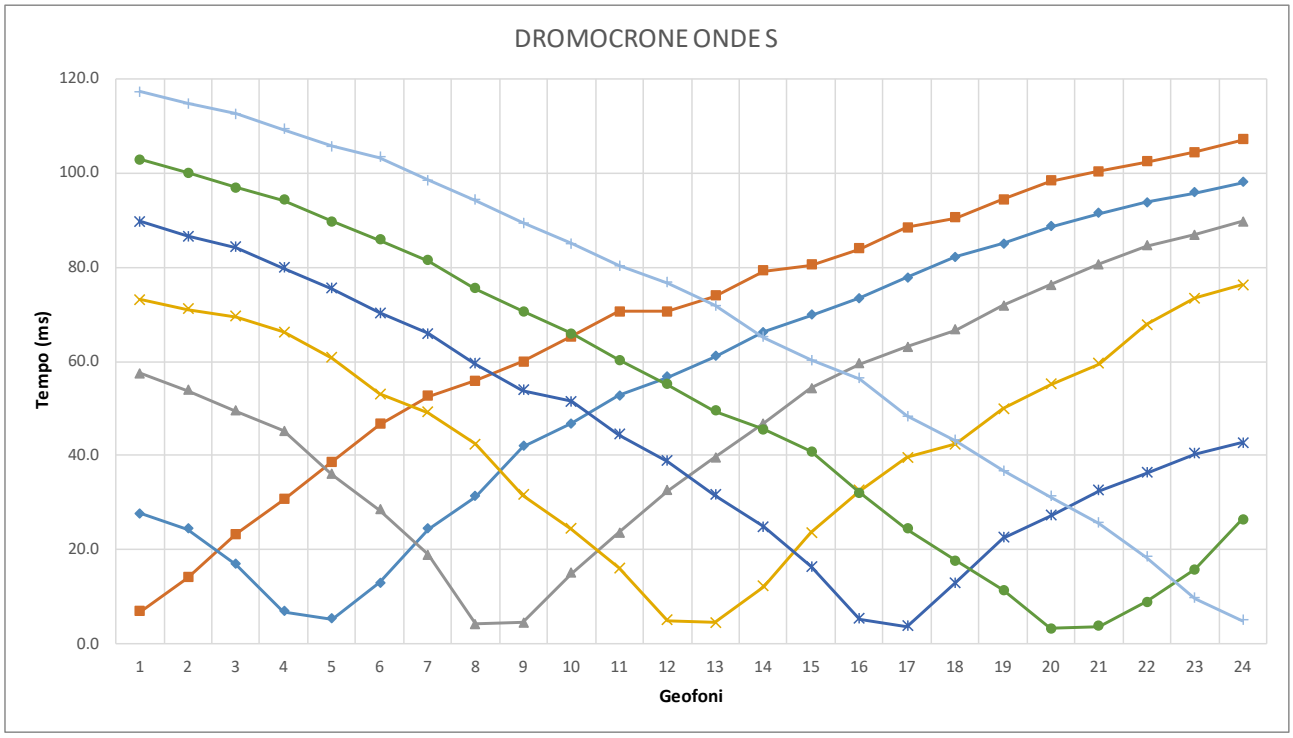


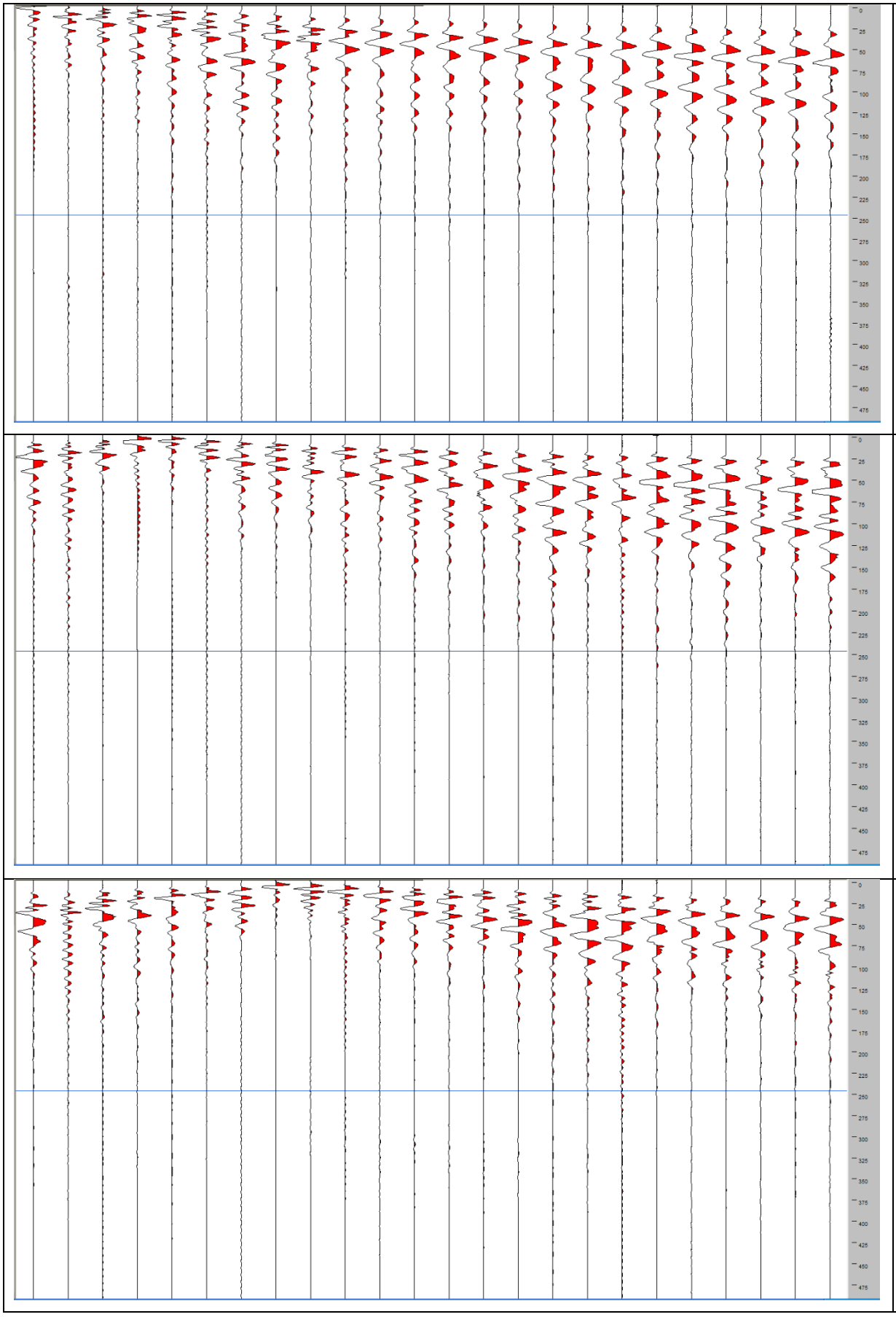
Tabella geometria e tempi onde S

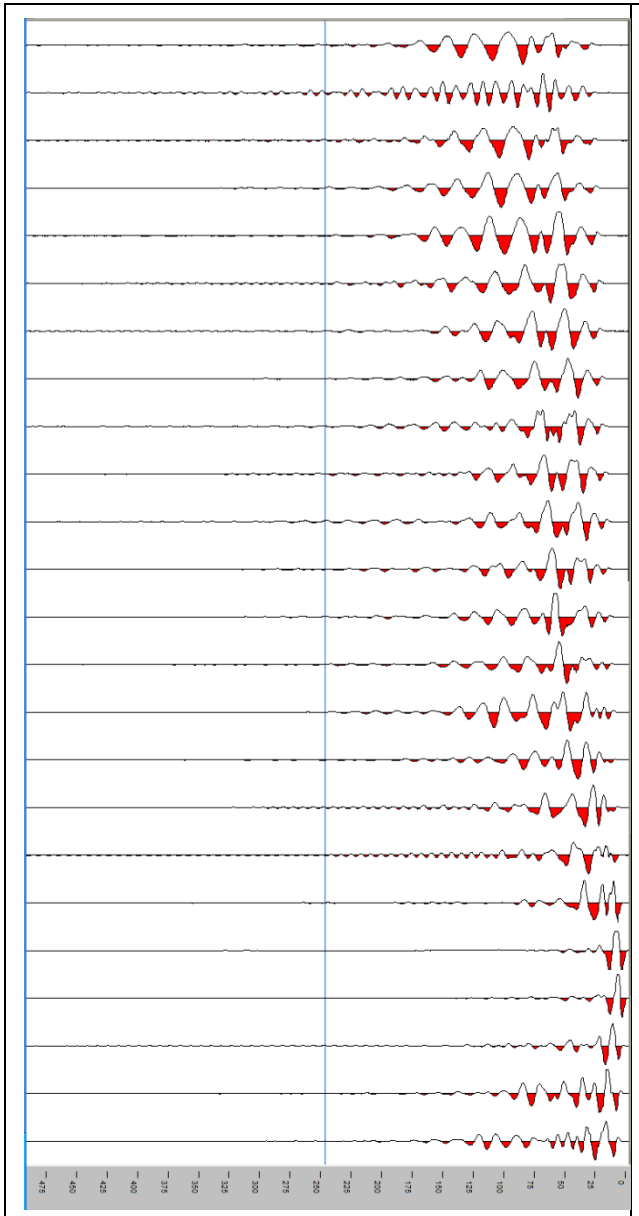
ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	233.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	6.9	14.2	23.4	30.7	38.7	46.6	52.6	55.9	59.9	65.2	70.5	70.5	73.8	79.1	80.4	83.8	88.4	90.4	94.4	98.3	100.3	102.3	104.3	107.0	Tempo (ms)
	Quota (m)	233.0																										
S2	Progressiva (m)	11.25	PS2	27.7	24.5	16.9	7.0	5.4	13.0	24.5	31.3	42.0	46.8	52.7	56.7	61.1	66.2	69.8	73.4	77.8	82.1	84.9	88.5	91.3	93.7	95.7	98.0	
	Quota (m)	233.0																										
S3	Progressiva (m)	21.25	PS3	57.5	53.9	49.5	45.2	36.0	28.5	18.9	4.2	4.6	15.0	23.7	32.5	39.6	46.8	54.3	59.5	63.1	66.6	71.8	76.2	80.6	84.5	86.9	89.7	
	Quota (m)	233.0																										
S4	Progressiva (m)	31.25	PS4	73.0	71.0	69.4	66.2	60.7	53.1	49.1	42.4	31.7	24.5	16.2	5.0	4.6	12.2	23.7	32.5	39.6	42.4	49.9	55.1	59.5	67.8	73.4	76.2	
	Quota (m)	233.0																										
S5	Progressiva (m)	41.25	PS5	89.7	86.5	84.1	79.8	75.4	70.2	65.8	59.5	53.9	51.5	44.4	38.8	31.7	24.9	16.5	5.4	3.8	13.0	22.5	27.3	32.5	36.4	40.4	42.8	
	Quota (m)	233.0																										
S6	Progressiva (m)	51.25	PS6	102.8	100.0	96.9	94.1	89.7	85.7	81.3	75.4	70.6	65.8	60.3	55.1	49.5	45.6	40.8	32.1	24.5	17.7	11.4	3.4	3.8	9.0	15.8	26.5	
	Quota (m)	233.0																										
S7	Progressiva (m)	61.25	PS7	117.1	114.7	112.4	109.2	105.6	103.2	98.4	94.1	89.3	84.9	80.2	76.6	71.8	65.1	60.3	56.3	48.4	43.2	36.8	31.3	25.7	18.5	9.8	5.0	



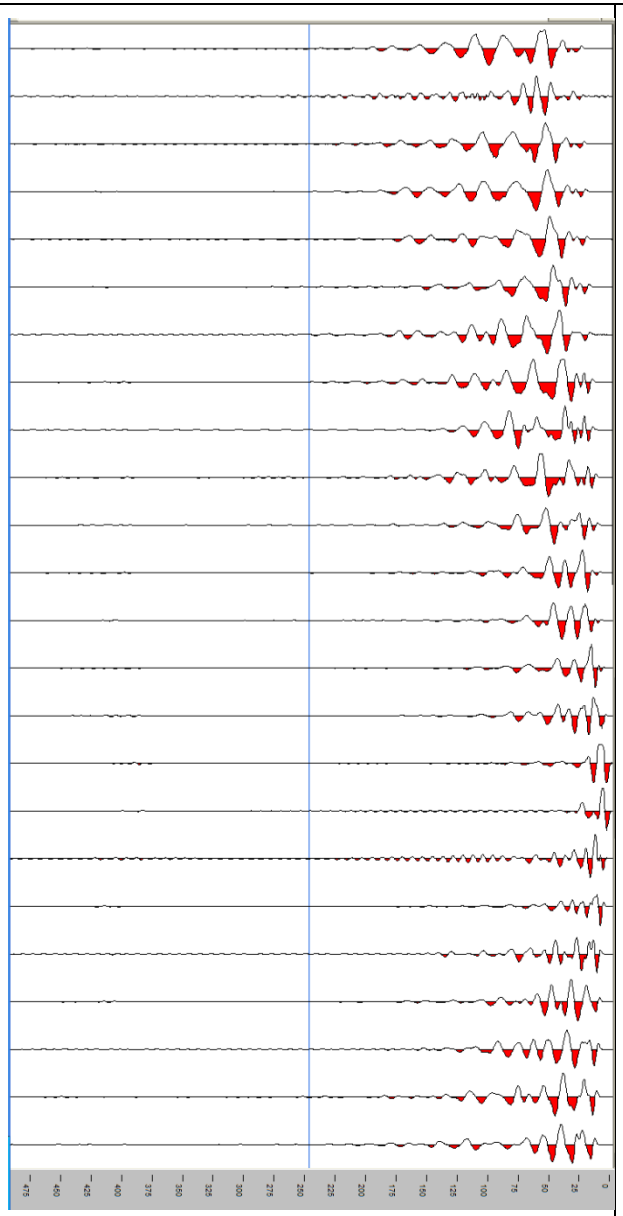
PROFILO SISMICO I

Sismogrammi onde P

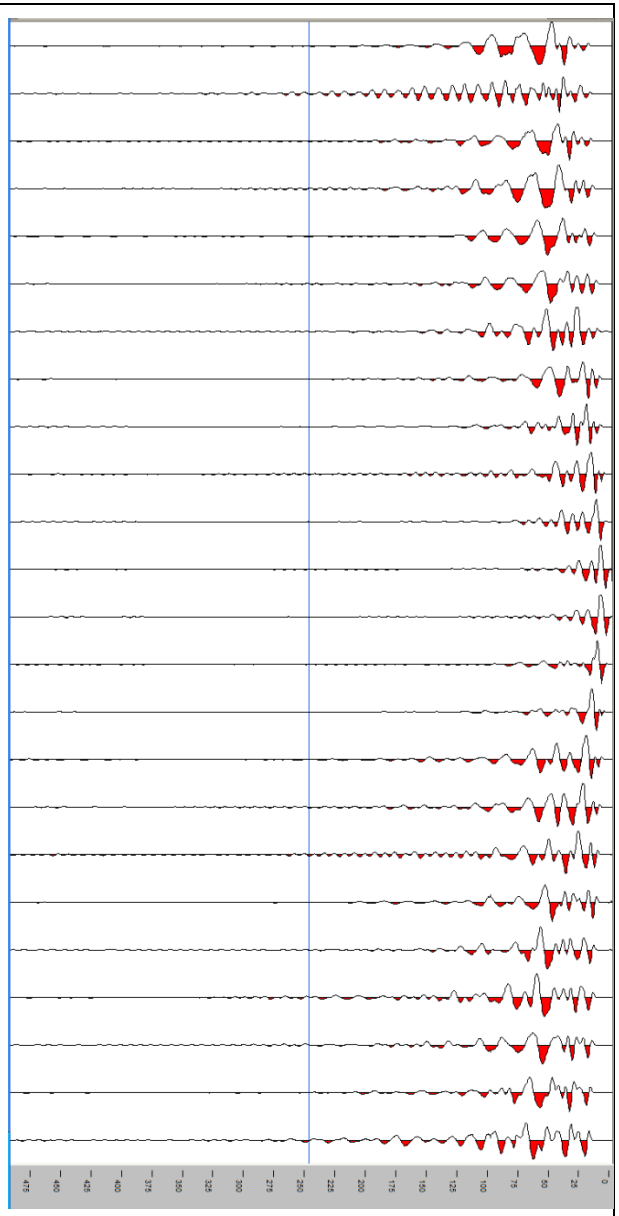




SP6



SP5



SP4

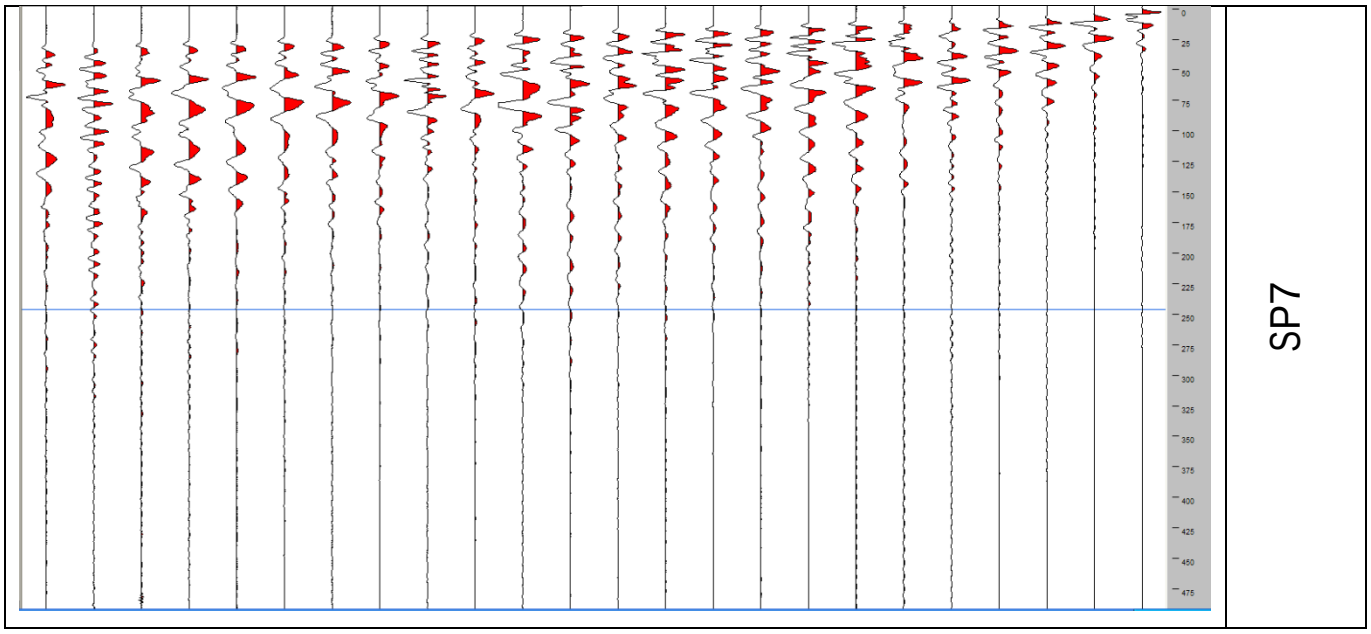
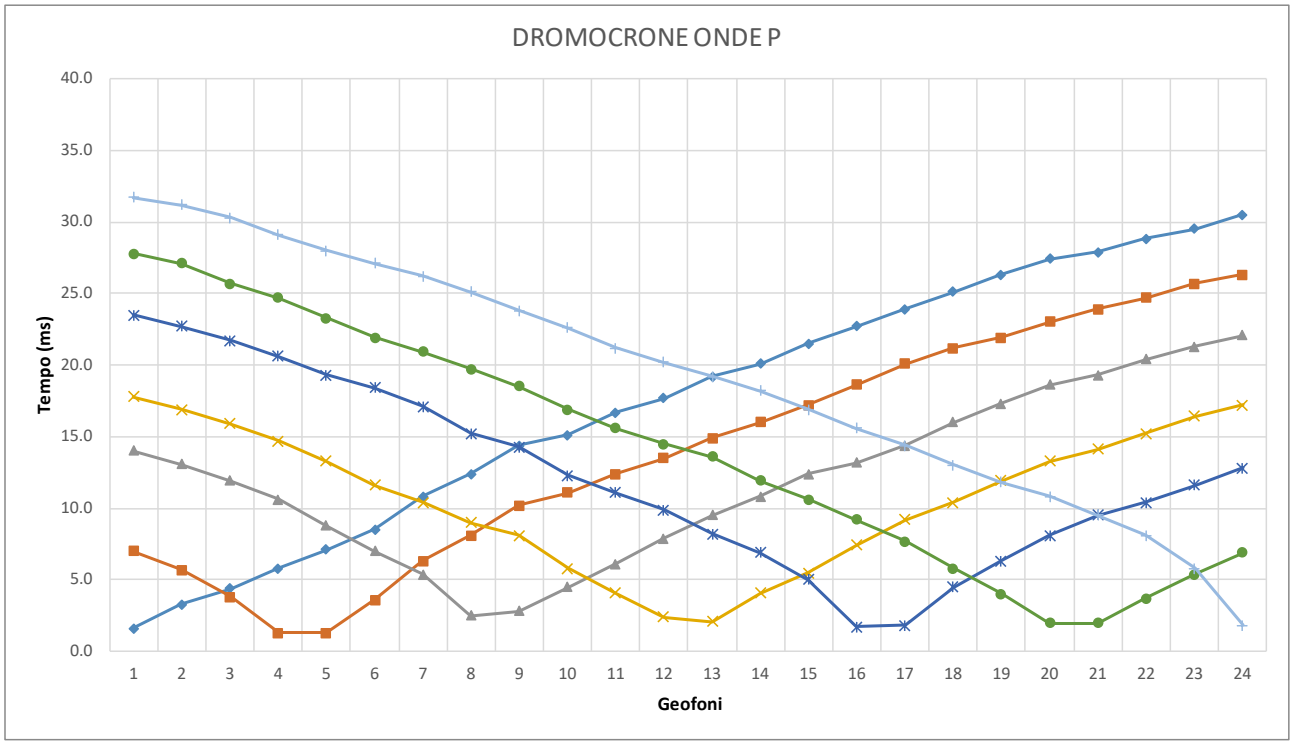
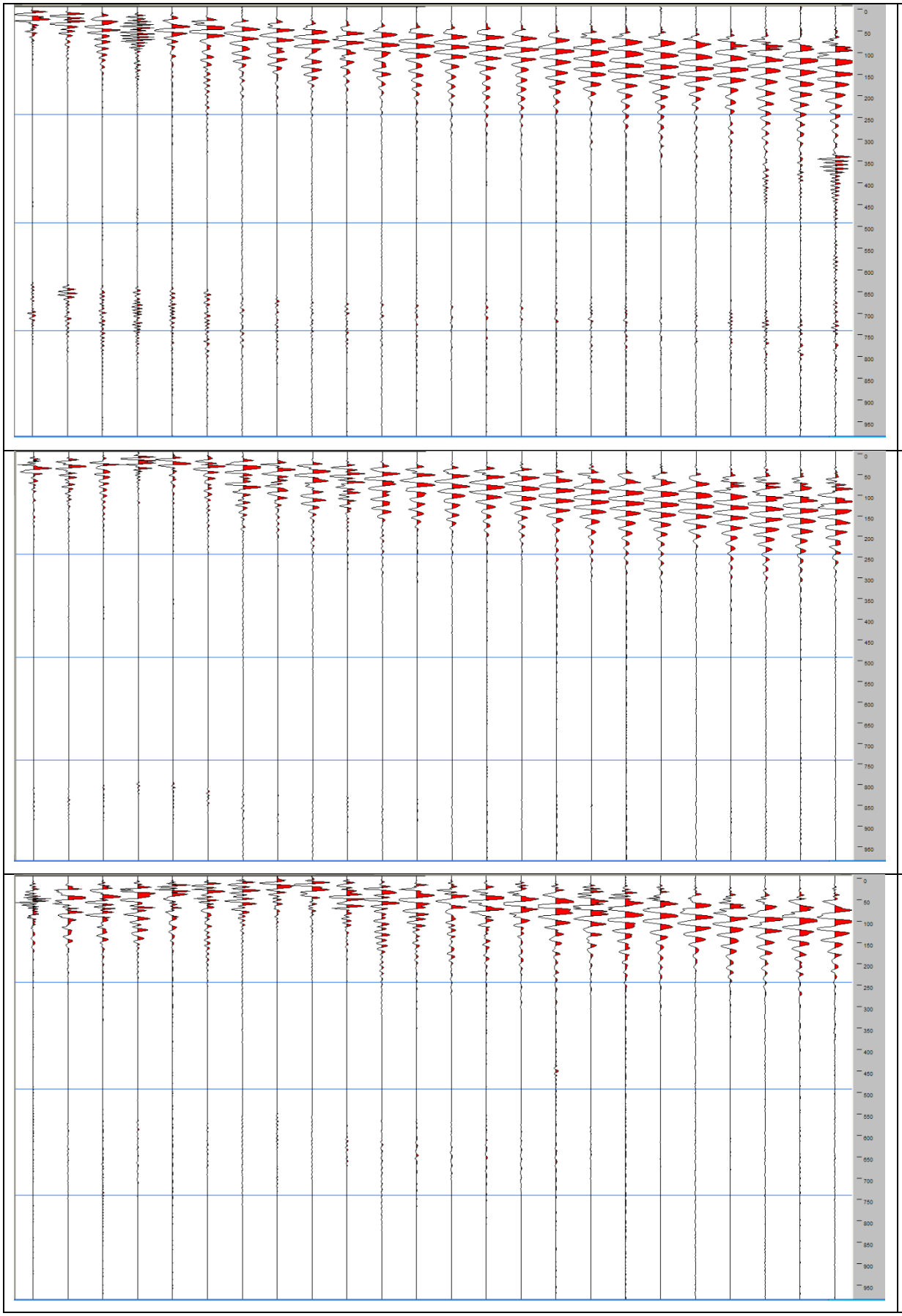


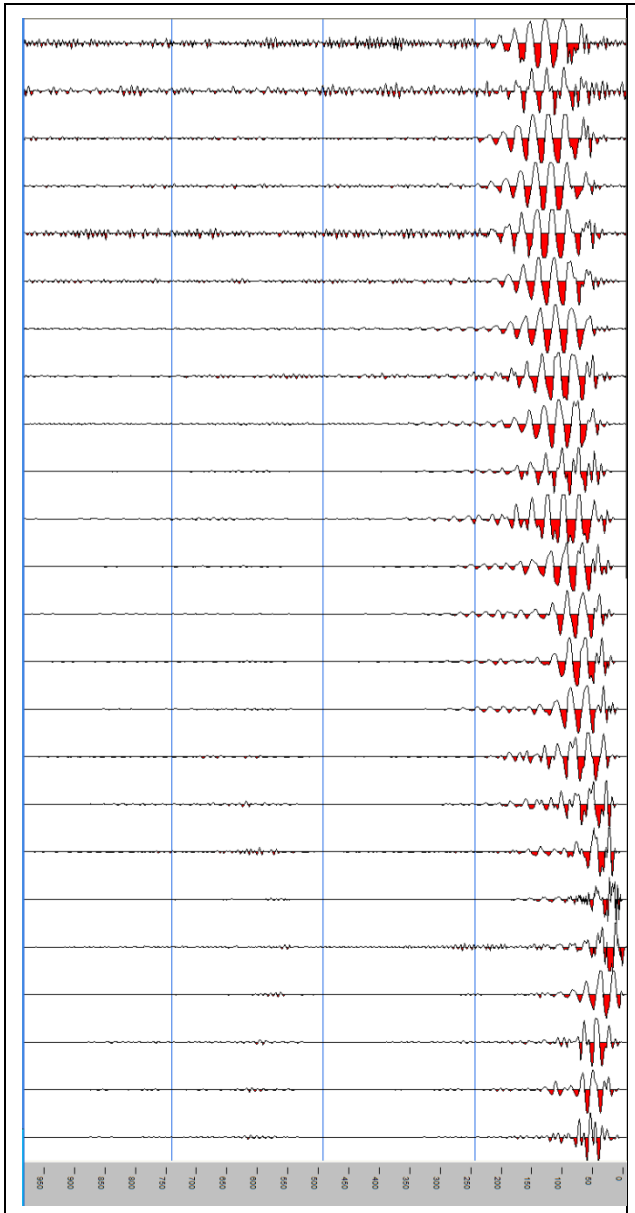
Tabella geometria e tempi onde P

ONDE P				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				4.35	6.82	9.29	11.76	14.23	16.71	19.17	21.64	24.11	26.58	29.05	31.53	34.02	36.5	38.99	41.47	43.95	46.44	48.91	51.38	53.84	56.31	58.78	61.25	Progressiva (m)
				331.8	331.4	331.1	330.7	330.3	329.9	329.5	329.1	328.7	328.3	328.0	327.7	327.4	327.1	326.8	326.6	326.3	326.0	325.6	325.2	324.8	324.4	324.0	323.6	Quota (m)
S1	Progressiva (m)	3.11	PS1	1.6	3.3	4.4	5.8	7.1	8.5	10.8	12.4	14.4	15.1	16.7	17.7	19.2	20.1	21.5	22.7	23.9	25.1	26.3	27.4	27.9	28.8	29.5	30.5	Tempo (ms)
	Quota (m)	332.0																										
S2	Progressiva (m)	13	PS2	7.0	5.7	3.8	1.3	1.3	3.6	6.3	8.1	10.2	11.1	12.4	13.5	14.9	16.0	17.2	18.6	20.1	21.2	21.9	23.0	23.9	24.7	25.7	26.3	
	Quota (m)	330.5																										
S3	Progressiva (m)	22.88	PS3	14.0	13.1	11.9	10.6	8.8	7.0	5.4	2.5	2.8	4.5	6.1	7.9	9.5	10.8	12.4	13.2	14.4	16.0	17.3	18.6	19.3	20.4	21.3	22.1	
	Quota (m)	328.9																										
S4	Progressiva (m)	32.78	PS4	17.8	16.9	15.9	14.7	13.3	11.6	10.4	9.0	8.1	5.8	4.1	2.4	2.1	4.1	5.5	7.4	9.2	10.4	11.9	13.3	14.1	15.2	16.4	17.2	
	Quota (m)	327.5																										
S5	Progressiva (m)	42.71	PS5	23.5	22.7	21.7	20.6	19.3	18.4	17.1	15.2	14.3	12.3	11.1	9.9	8.2	6.9	5.0	1.7	1.8	4.5	6.3	8.1	9.5	10.4	11.6	12.8	
	Quota (m)	326.4																										
S6	Progressiva (m)	52.61	PS6	27.8	27.1	25.7	24.7	23.3	21.9	20.9	19.7	18.5	16.9	15.6	14.5	13.6	11.9	10.6	9.2	7.7	5.8	4.0	2.0	2.0	3.7	5.4	6.9	
	Quota (m)	325.0																										
S7	Progressiva (m)	62.48	PS7	31.7	31.2	30.3	29.1	28.0	27.1	26.2	25.1	23.8	22.6	21.2	20.2	19.2	18.2	16.9	15.6	14.4	13.0	11.8	10.8	9.5	8.1	5.8	1.8	
	Quota (m)	323.4																										

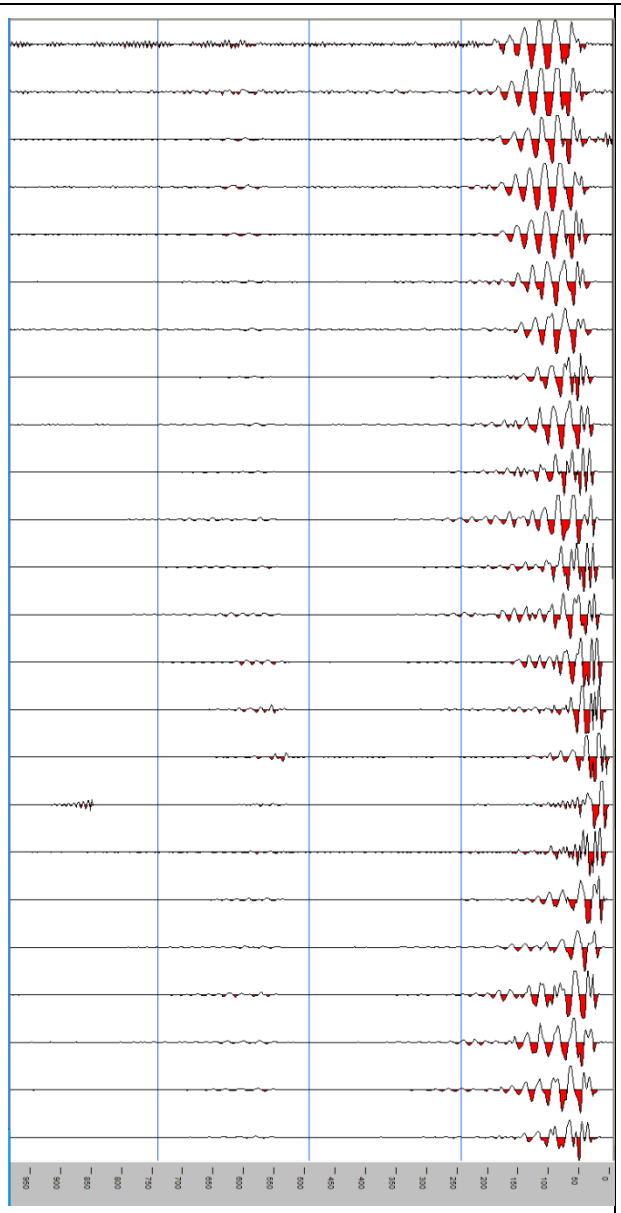


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

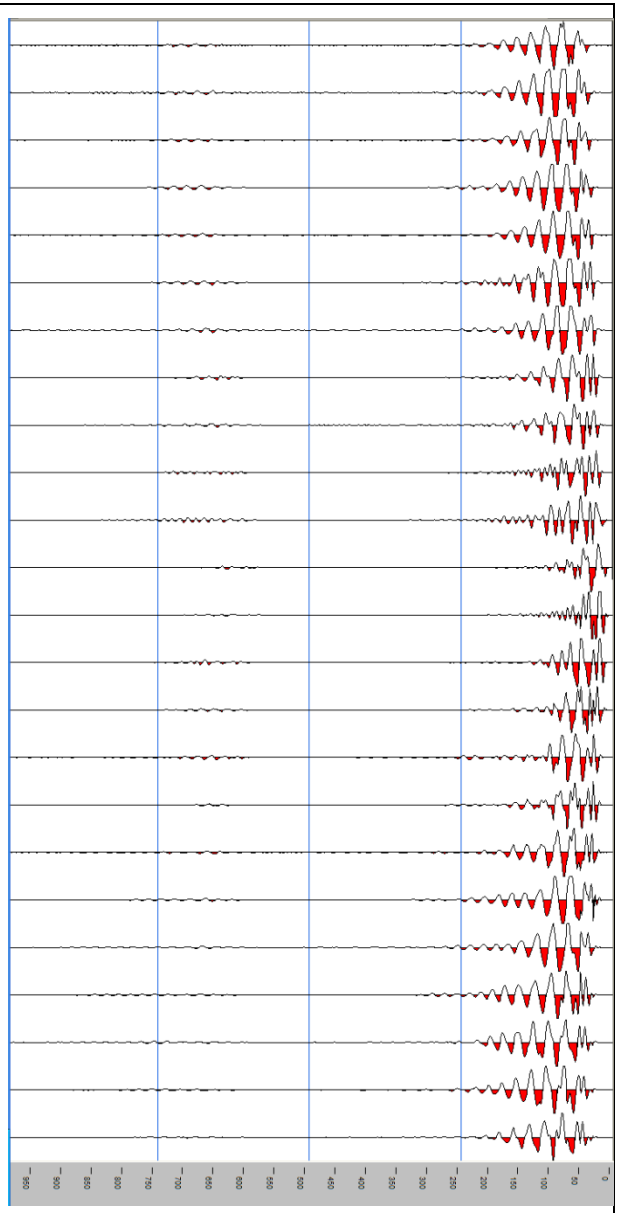




SP6



SP5



SP4

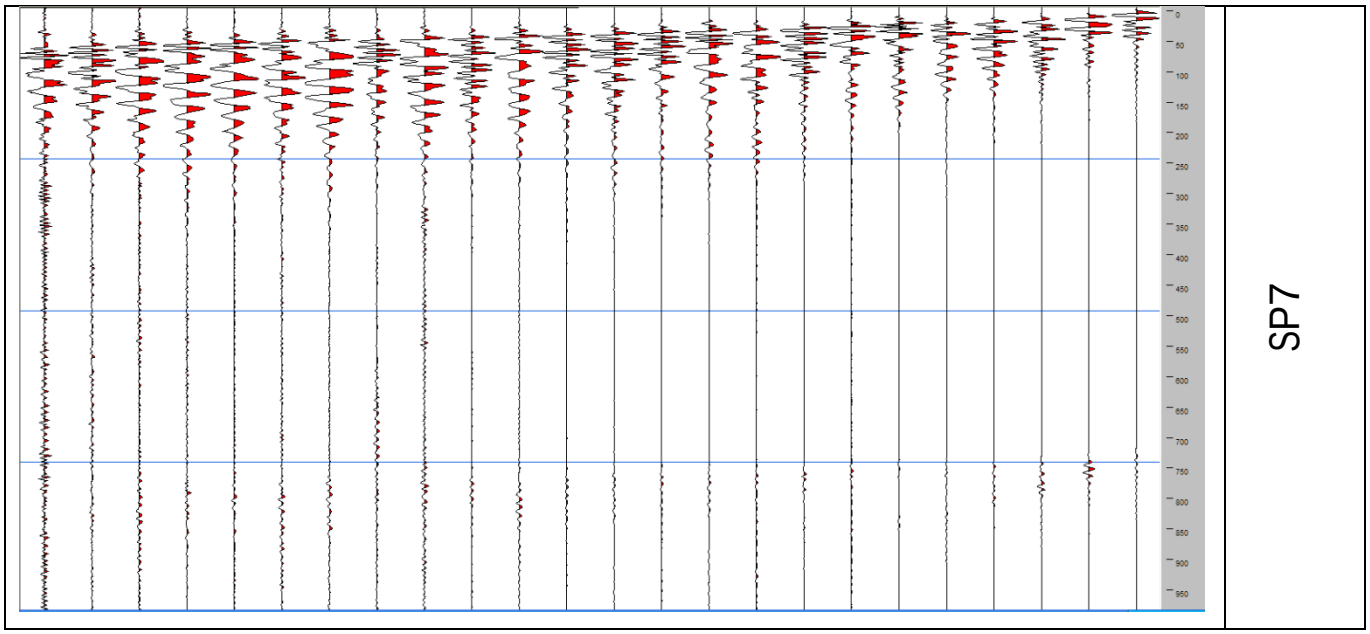
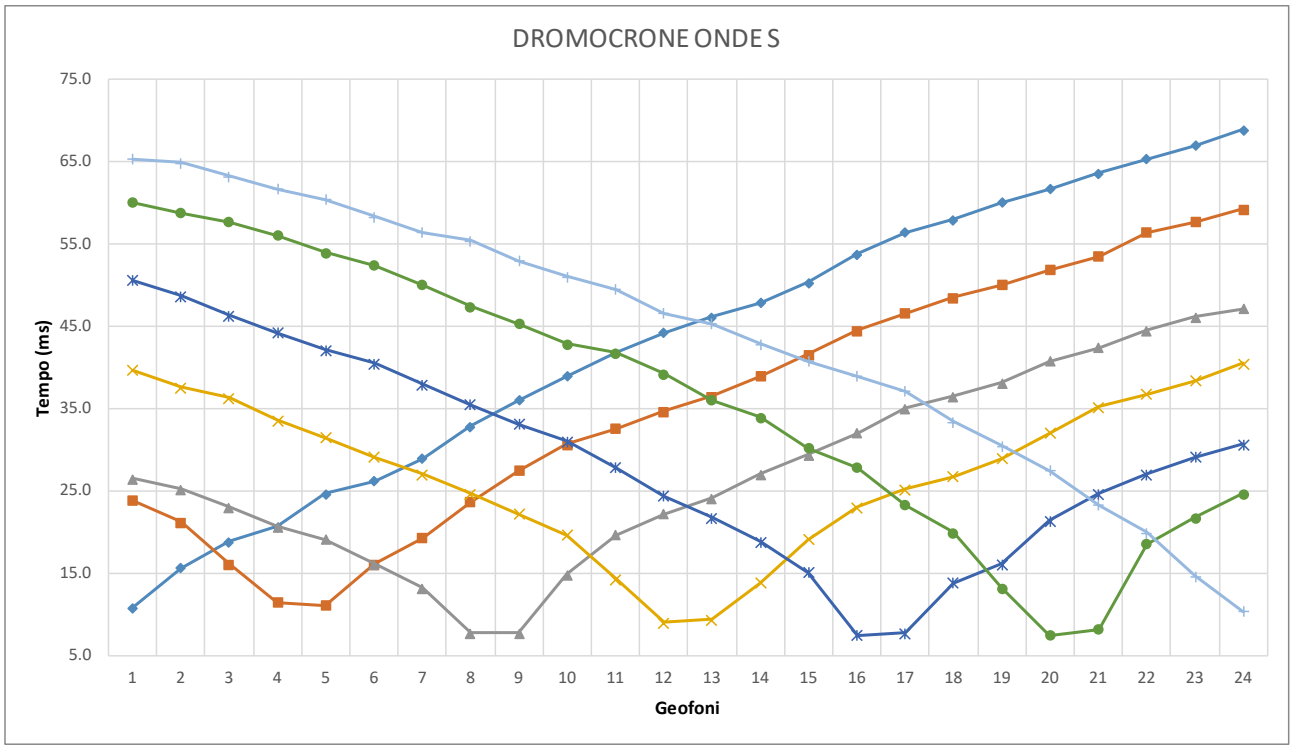


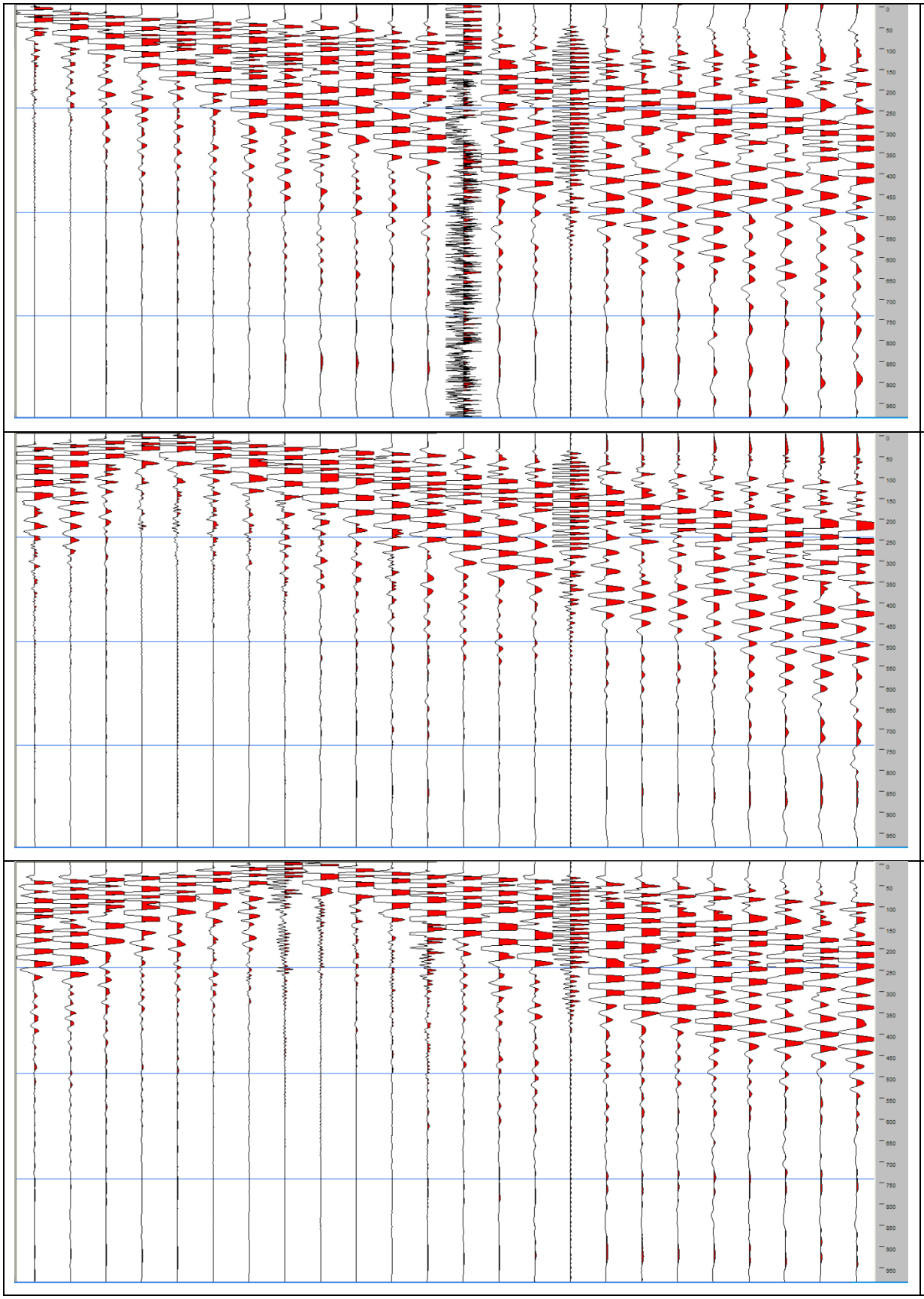
Tabella geometria e tempi onde S

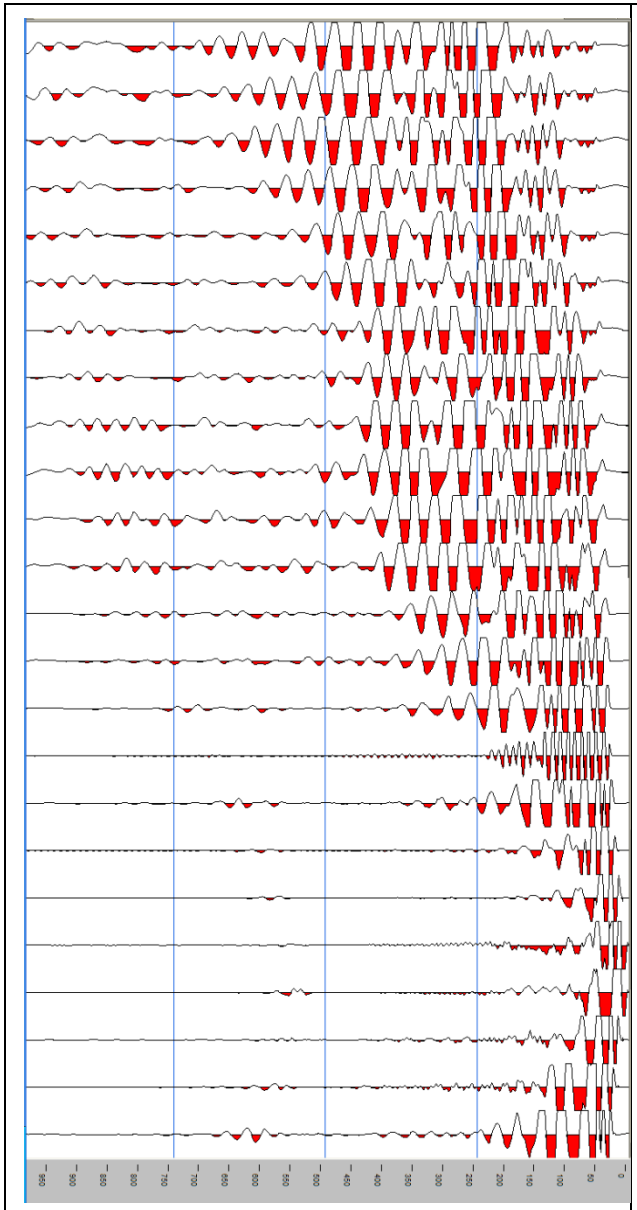
ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				4.35	6.82	9.29	11.76	14.23	16.71	19.17	21.64	24.11	26.58	29.05	31.53	34.02	36.5	38.99	41.47	43.95	46.44	48.91	51.38	53.84	56.31	58.78	61.25	Progressiva (m)
				331.8	331.4	331.1	330.7	330.3	329.9	329.5	329.1	328.7	328.3	328.0	327.7	327.4	327.1	326.8	326.6	326.3	326.0	325.6	325.2	324.8	324.4	324.0	323.6	Quota (m)
S1	Progressiva (m)	3.11	PS1	10.8	15.6	18.8	20.6	24.6	26.2	28.9	32.8	36.0	38.9	41.8	44.2	46.1	47.9	50.3	53.8	56.4	58.0	60.1	61.7	63.6	65.4	67.0	68.9	Tempo (ms)
	Quota (m)	332.0																										
S2	Progressiva (m)	13	PS2	23.8	21.2	16.1	11.4	11.1	16.1	19.3	23.6	27.5	30.7	32.6	34.7	36.5	38.9	41.6	44.5	46.6	48.5	50.1	51.9	53.5	56.4	57.7	59.3	
	Quota (m)	330.5																										
S3	Progressiva (m)	22.88	PS3	26.5	25.2	23.0	20.6	19.1	16.1	13.2	7.7	7.7	14.8	19.6	22.2	24.1	27.0	29.4	32.0	35.0	36.5	38.1	40.8	42.4	44.5	46.1	47.1	
	Quota (m)	328.9																										
S4	Progressiva (m)	32.78	PS4	39.7	37.6	36.3	33.6	31.5	29.1	27.0	24.6	22.2	19.6	14.3	9.0	9.3	13.8	19.1	23.0	25.2	26.7	28.9	32.0	35.2	36.8	38.4	40.5	
	Quota (m)	327.5																										
S5	Progressiva (m)	42.71	PS5	50.6	48.7	46.3	44.2	42.1	40.5	37.9	35.5	33.1	31.0	27.8	24.4	21.7	18.8	15.1	7.4	7.7	13.8	16.1	21.4	24.6	27.0	29.1	30.7	
	Quota (m)	326.4																										
S6	Progressiva (m)	52.61	PS6	60.1	58.8	57.7	56.1	54.0	52.4	50.1	47.4	45.3	42.9	41.8	39.2	36.0	33.9	30.2	27.8	23.3	19.9	13.2	7.4	8.2	18.5	21.7	24.6	
	Quota (m)	325.0																										
S7	Progressiva (m)	62.48	PS7	65.4	64.9	63.3	61.7	60.4	58.3	56.4	55.4	53.0	51.1	49.5	46.6	45.3	42.9	40.8	38.9	37.1	33.4	30.5	27.5	23.3	19.9	14.6	10.3	
	Quota (m)	323.4																										



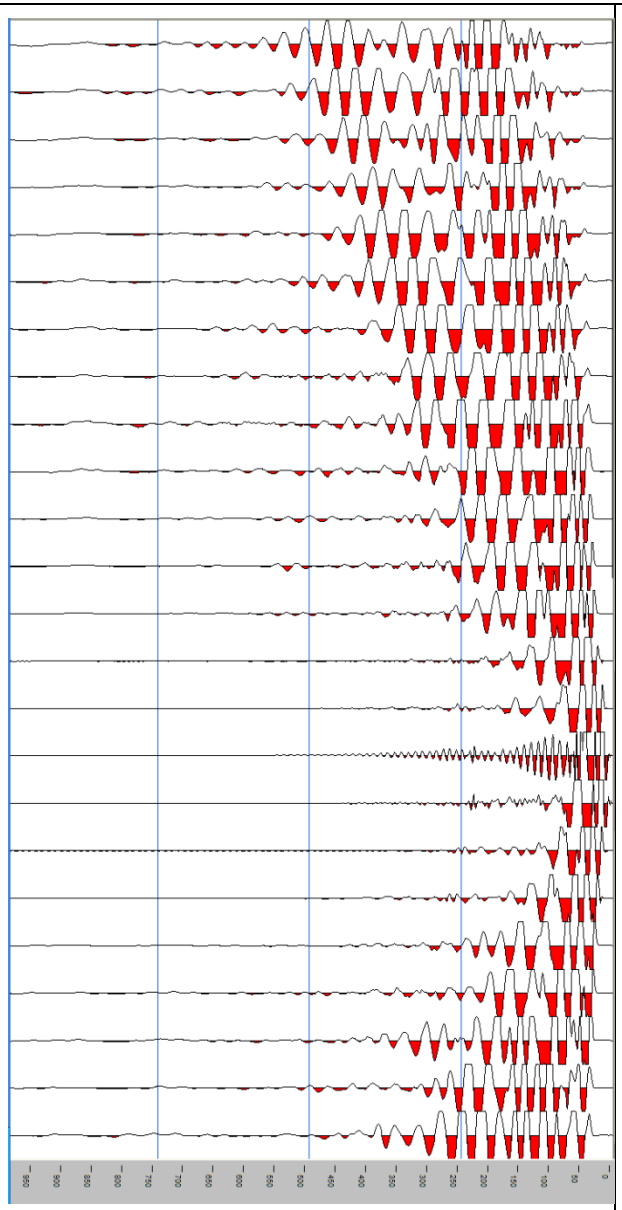
PROFILO SISMICO L

Sismogrammi onde P

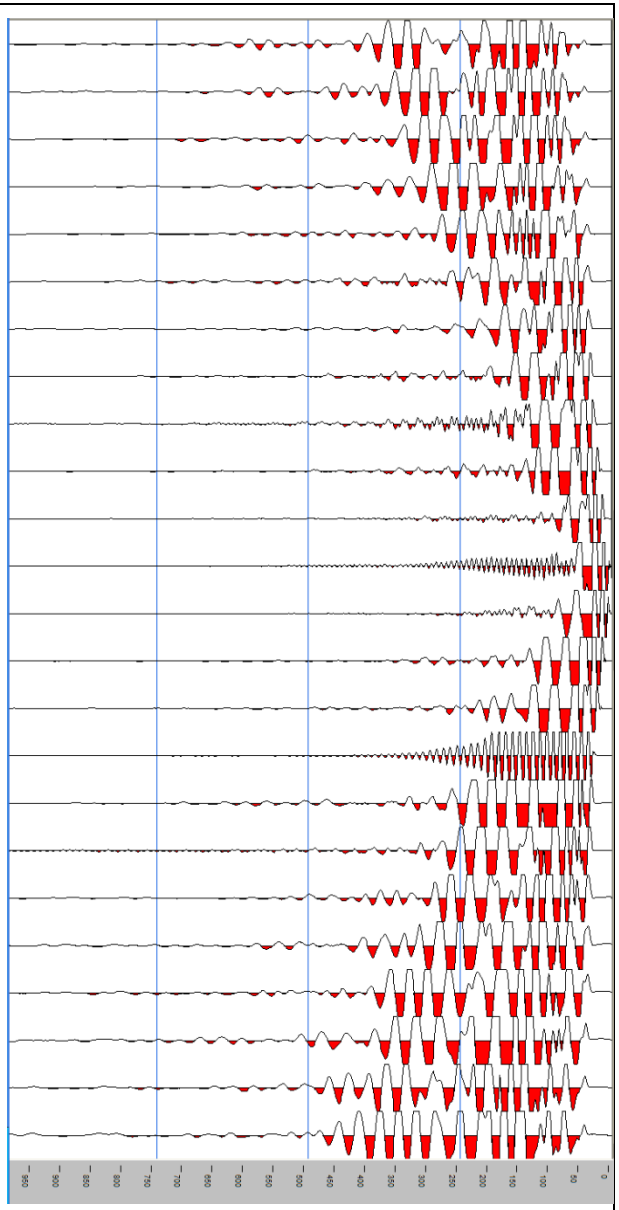




SP6



SP5



SP4

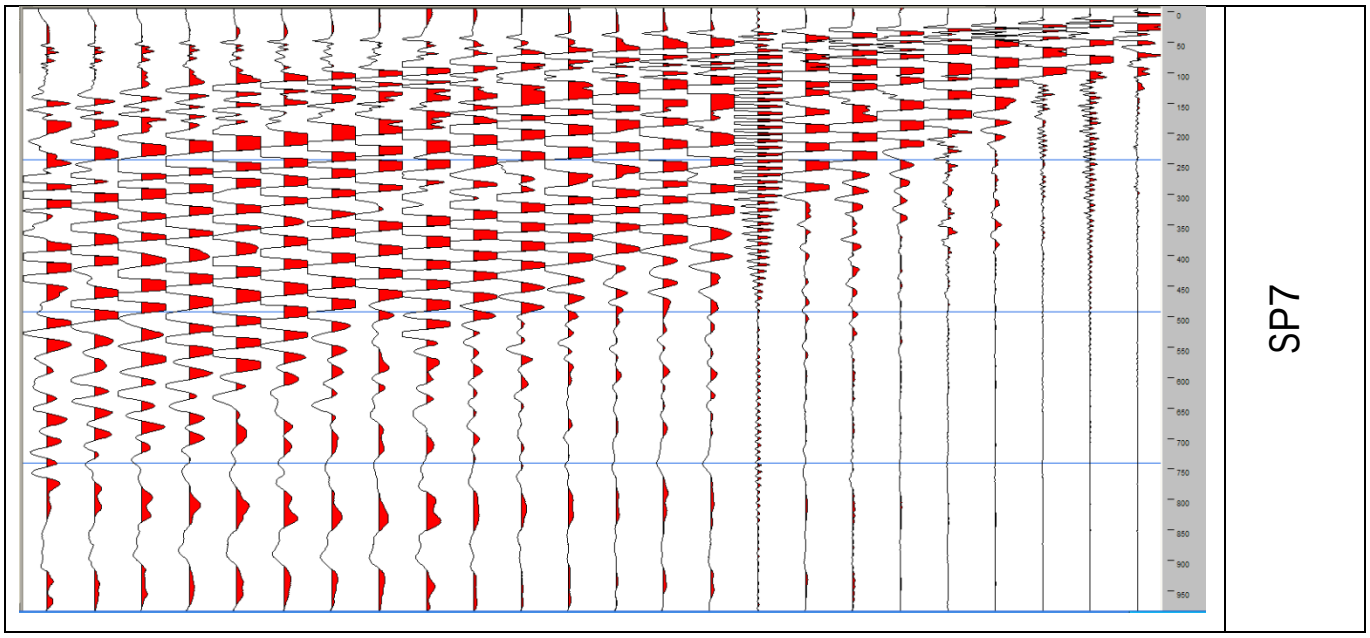
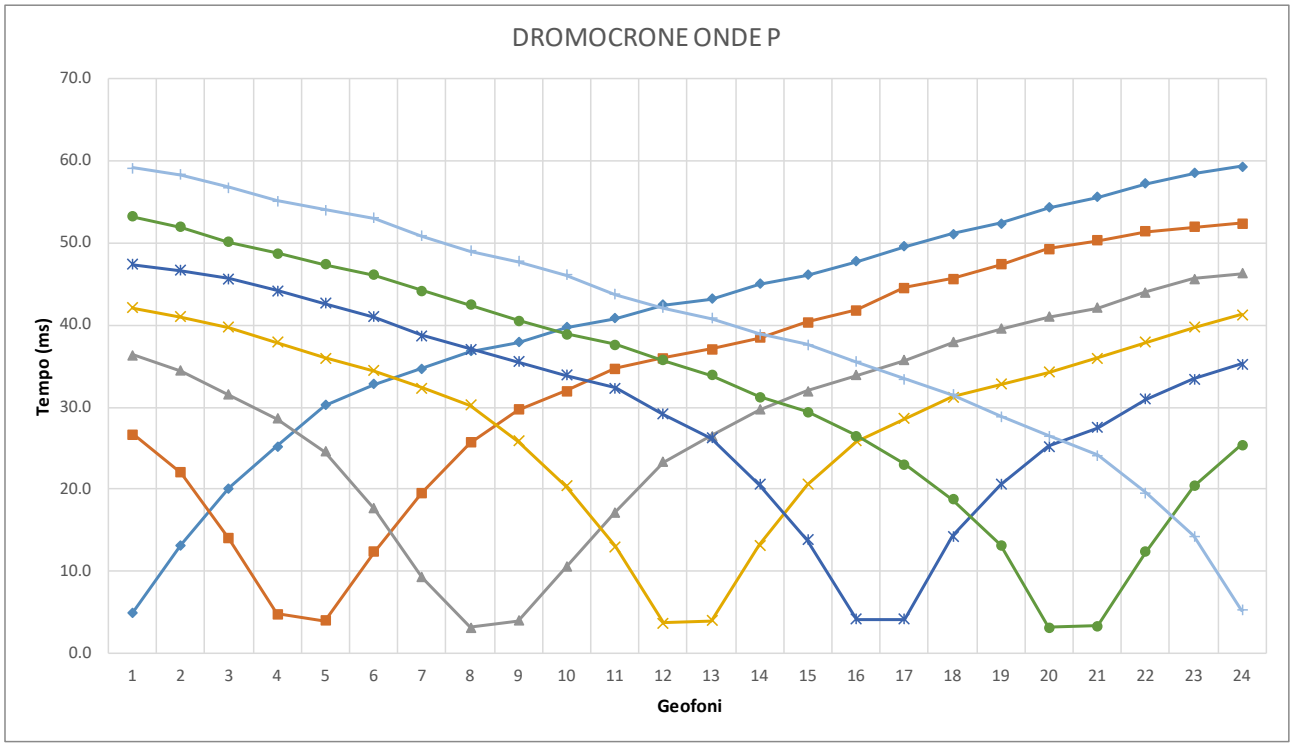
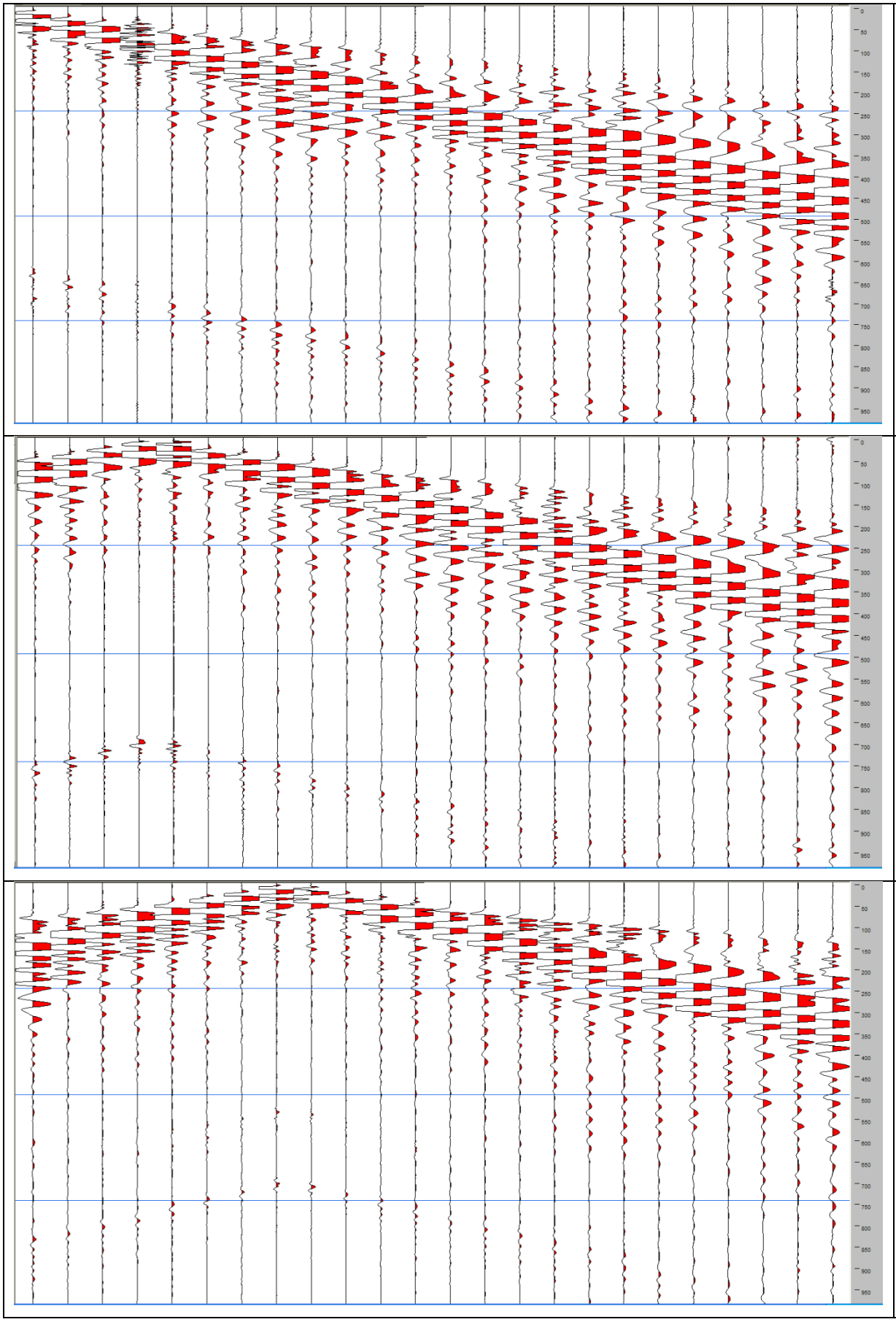


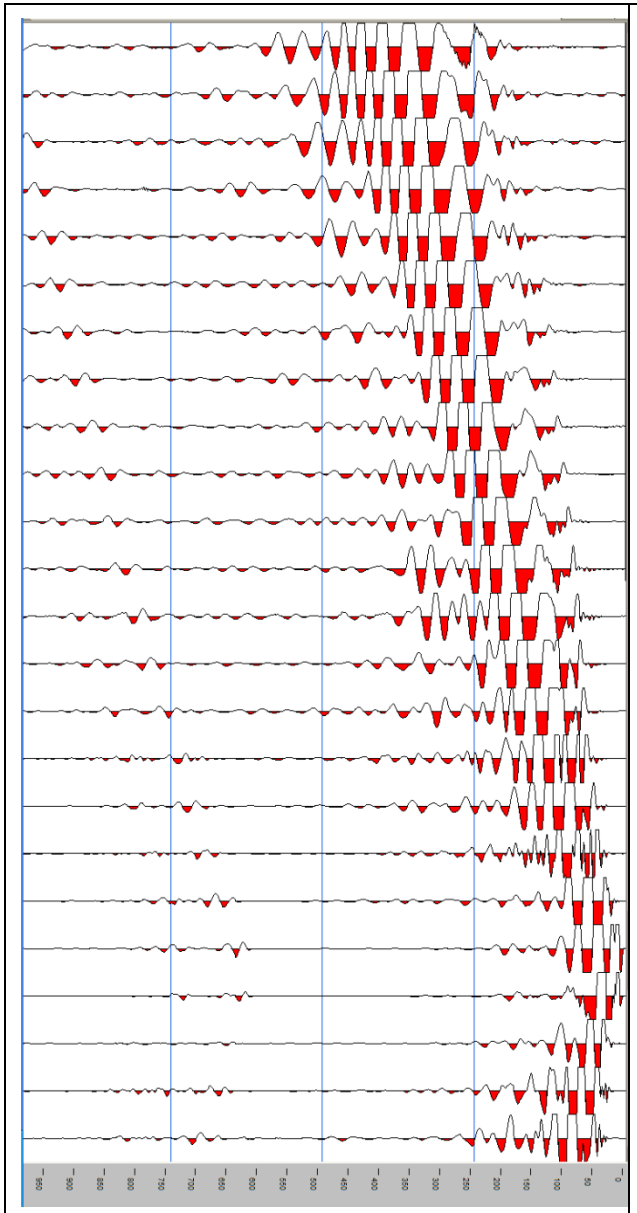
Tabella geometria e tempi onde P

ONDE P				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	5.0	13.2	20.1	25.2	30.2	32.8	34.7	36.8	37.9	39.7	40.8	42.4	43.2	45.0	46.1	47.7	49.5	51.1	52.4	54.3	55.6	57.2	58.5	59.3	Tempo (ms)
	Quota (m)	150.0																										
S2	Progressiva (m)	11.25	PS2	26.7	22.0	14.0	4.8	4.0	12.4	19.6	25.7	29.7	32.0	34.7	36.0	37.1	38.4	40.3	41.8	44.5	45.6	47.4	49.3	50.3	51.4	51.9	52.4	
	Quota (m)	150.0																										
S3	Progressiva (m)	21.25	PS3	36.3	34.4	31.5	28.6	24.6	17.7	9.3	3.2	4.0	10.6	17.2	23.3	26.5	29.7	32.0	33.9	35.7	37.9	39.5	41.0	42.1	44.0	45.6	46.3	
	Quota (m)	150.0																										
S4	Progressiva (m)	31.25	PS4	42.1	41.0	39.7	37.9	36.0	34.4	32.3	30.2	25.9	20.4	13.0	3.7	4.0	13.2	20.6	25.9	28.6	31.2	32.8	34.2	36.0	37.9	39.7	41.3	
	Quota (m)	150.0																										
S5	Progressiva (m)	41.25	PS5	47.4	46.6	45.6	44.2	42.6	41.0	38.7	37.1	35.5	33.9	32.3	29.1	26.2	20.6	13.8	4.2	4.2	14.3	20.6	25.2	27.5	31.0	33.4	35.2	
	Quota (m)	150.0																										
S6	Progressiva (m)	51.25	PS6	53.2	51.9	50.1	48.7	47.4	46.1	44.2	42.4	40.5	38.9	37.6	35.7	33.9	31.2	29.4	26.5	23.0	18.8	13.2	3.2	3.4	12.4	20.4	25.4	
	Quota (m)	150.0																										
S7	Progressiva (m)	61.25	PS7	59.1	58.3	56.7	55.1	54.0	53.0	50.8	49.0	47.7	46.1	43.7	42.1	40.8	38.9	37.6	35.5	33.4	31.5	28.9	26.5	24.1	19.6	14.3	5.3	
	Quota (m)	150.0																										

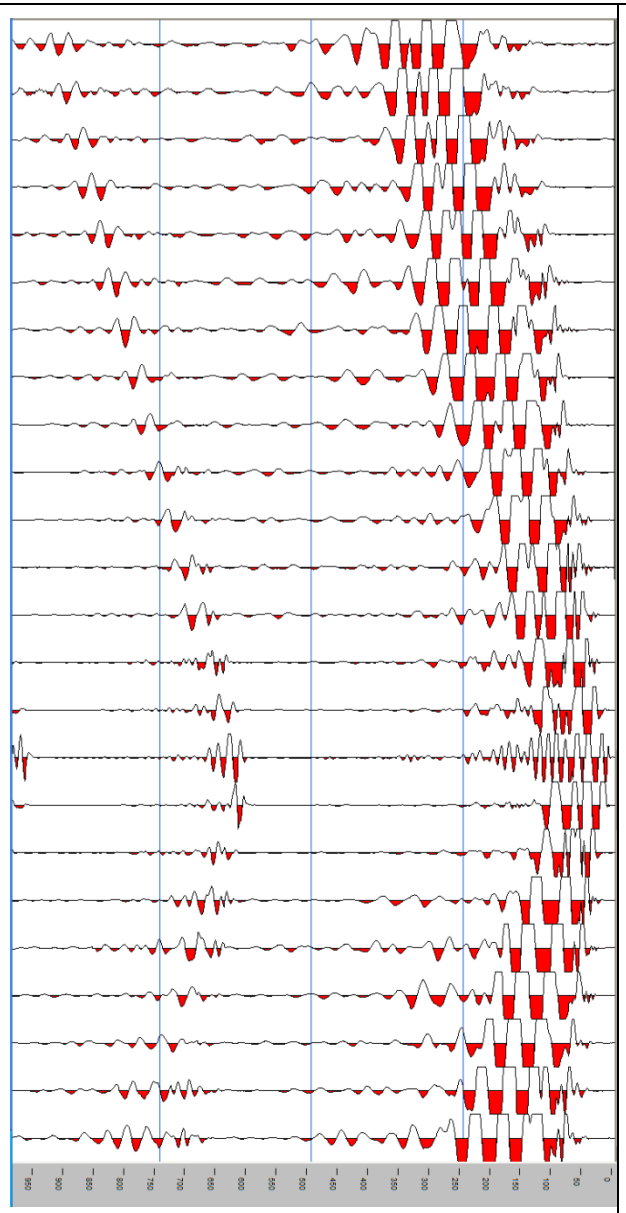


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

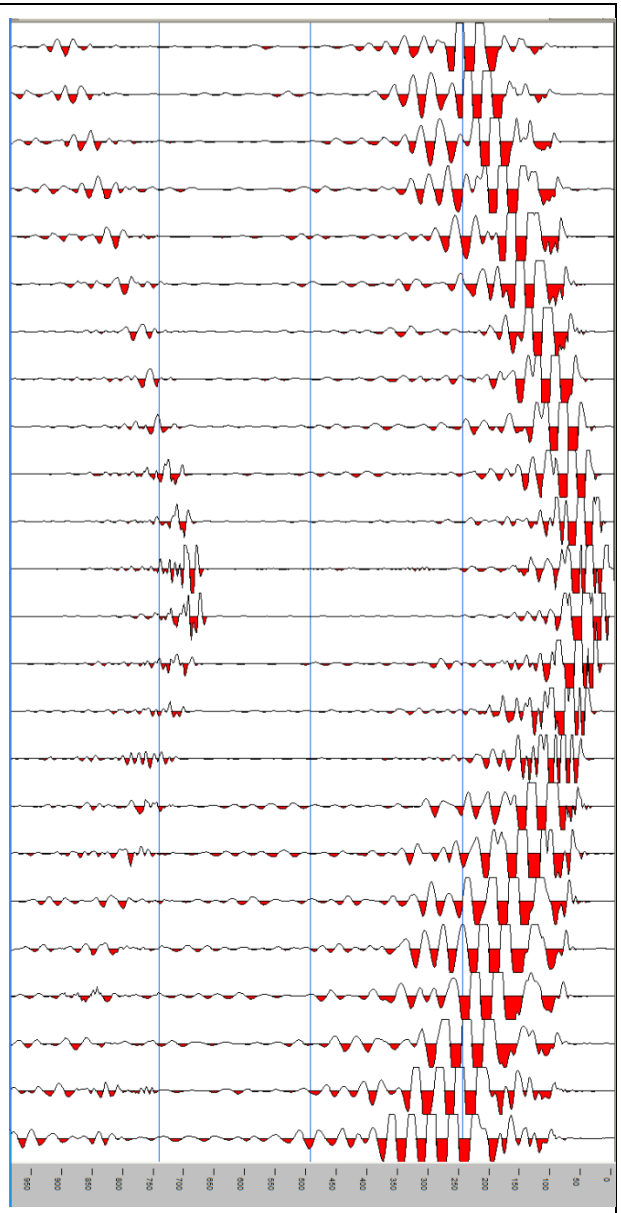




SP6



SP5



SP4

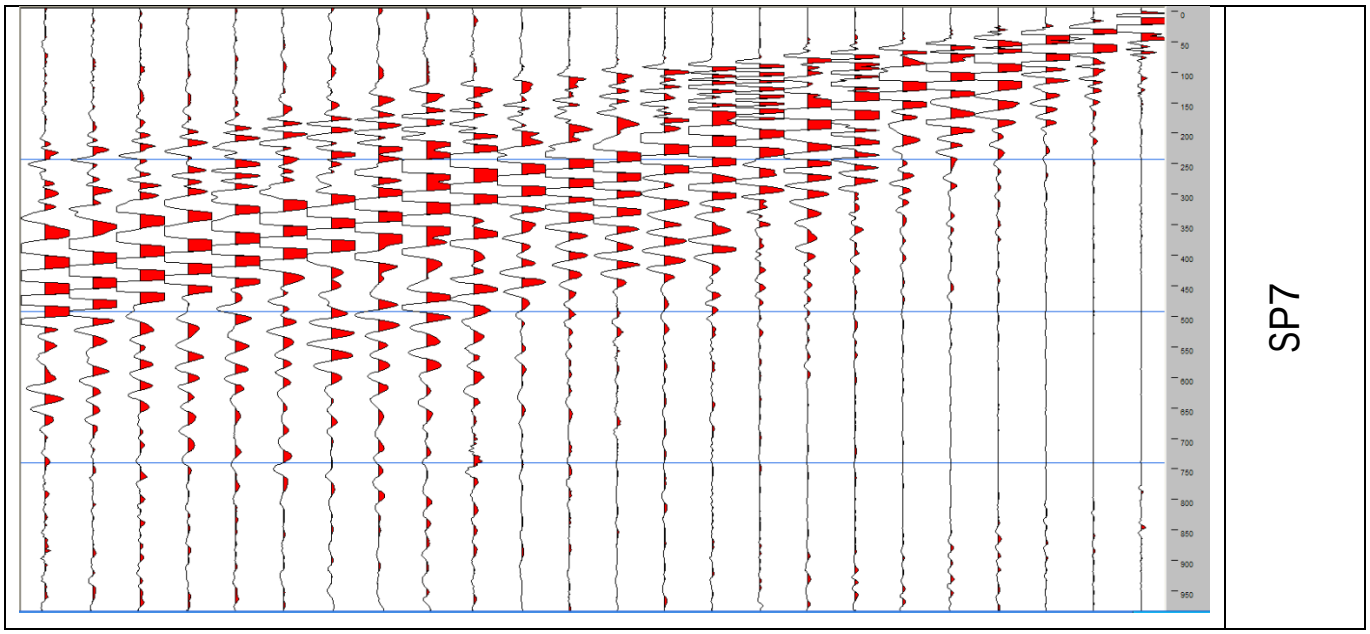
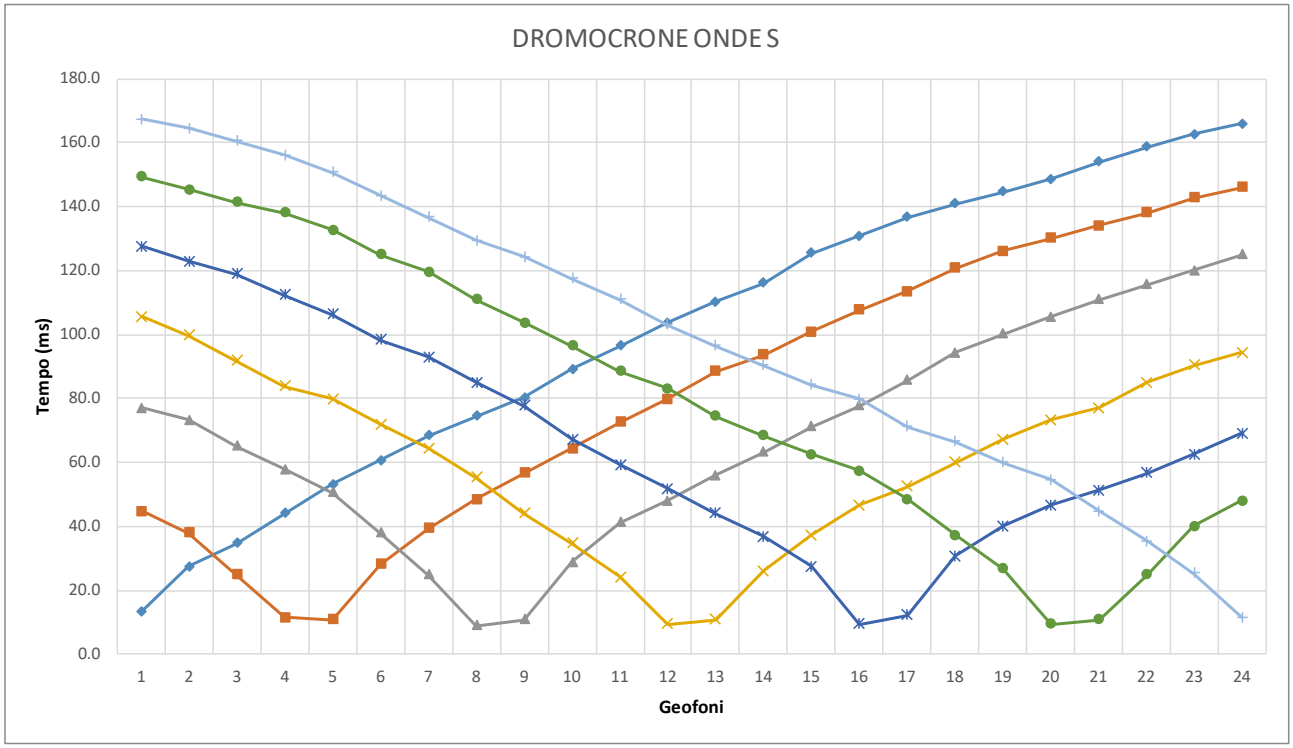


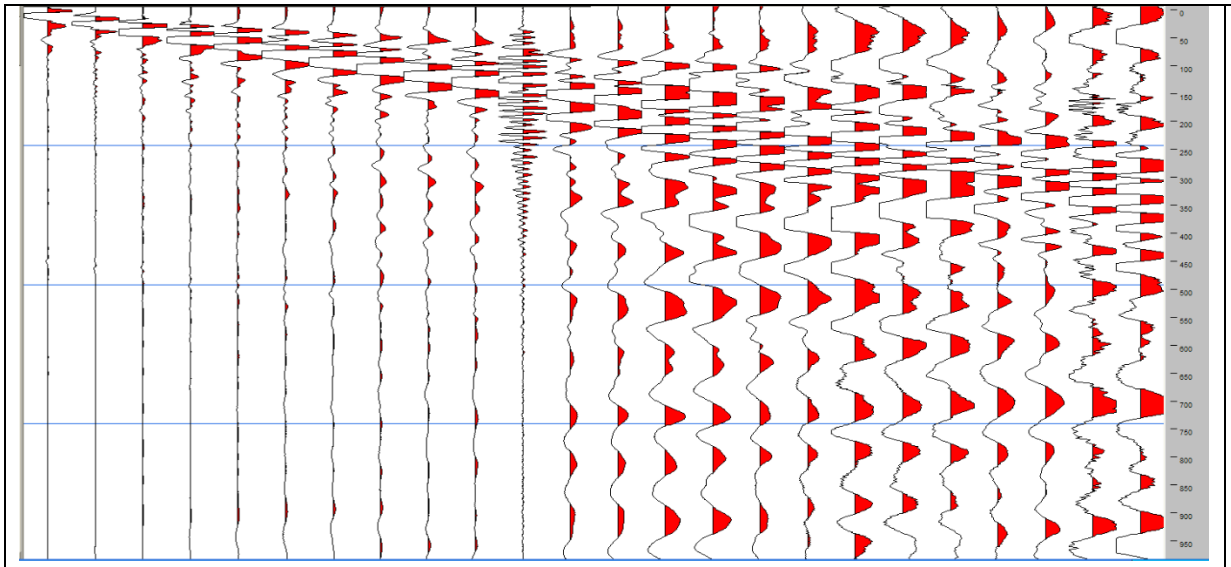
Tabella geometria e tempi onde S

ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	13.5	27.4	34.7	44.0	53.3	60.6	68.5	74.5	80.4	89.1	96.4	103.6	110.3	116.2	125.5	130.8	136.8	140.8	144.7	148.7	154.0	158.7	162.6	165.9	Tempo (ms)
	Quota (m)	150.0																										
S2	Progressiva (m)	11.25	PS2	44.7	38.0	24.8	11.5	10.9	28.1	39.4	48.6	56.6	64.5	72.5	79.8	88.4	93.7	101.0	107.6	113.6	120.9	126.2	130.2	134.1	138.1	142.8	146.1	
	Quota (m)	150.0																										
S3	Progressiva (m)	21.25	PS3	77.1	73.2	65.2	57.9	50.6	38.0	24.8	8.9	10.9	28.8	41.3	48.0	55.9	63.2	71.2	77.8	85.8	94.4	100.3	105.6	110.9	115.6	120.2	124.9	
	Quota (m)	150.0																										
S4	Progressiva (m)	31.25	PS4	105.6	99.7	91.7	83.8	79.8	71.8	64.5	55.3	44.0	34.7	24.1	9.5	10.9	26.1	37.4	46.6	52.6	59.9	67.2	73.2	77.1	85.1	90.4	94.4	
	Quota (m)	150.0																										
S5	Progressiva (m)	41.25	PS5	127.5	122.9	118.9	112.3	106.3	98.3	93.0	85.1	77.8	67.2	59.2	51.9	44.0	36.7	27.4	9.5	12.2	30.7	40.0	46.6	51.3	56.6	62.6	69.2	
	Quota (m)	150.0																										
S6	Progressiva (m)	51.25	PS6	149.4	145.4	141.4	138.1	132.8	124.9	119.6	110.9	103.6	96.4	88.4	83.1	74.5	68.5	62.6	57.3	48.6	37.4	26.8	9.5	10.9	24.8	40.0	48.0	
	Quota (m)	150.0																										
S7	Progressiva (m)	61.25	PS7	167.3	164.6	160.6	156.0	150.7	143.4	136.8	129.5	124.2	117.6	110.9	103.0	96.4	90.4	84.4	79.8	71.2	66.5	59.9	54.6	44.7	35.4	25.4	11.5	
	Quota (m)	150.0																										

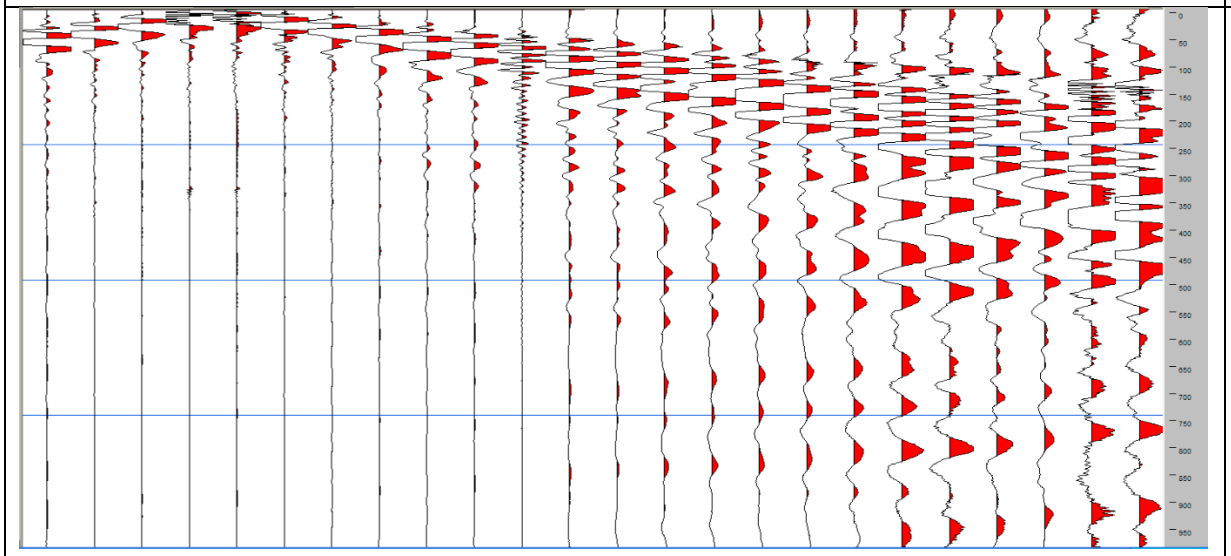


PROFILO SISMICO M

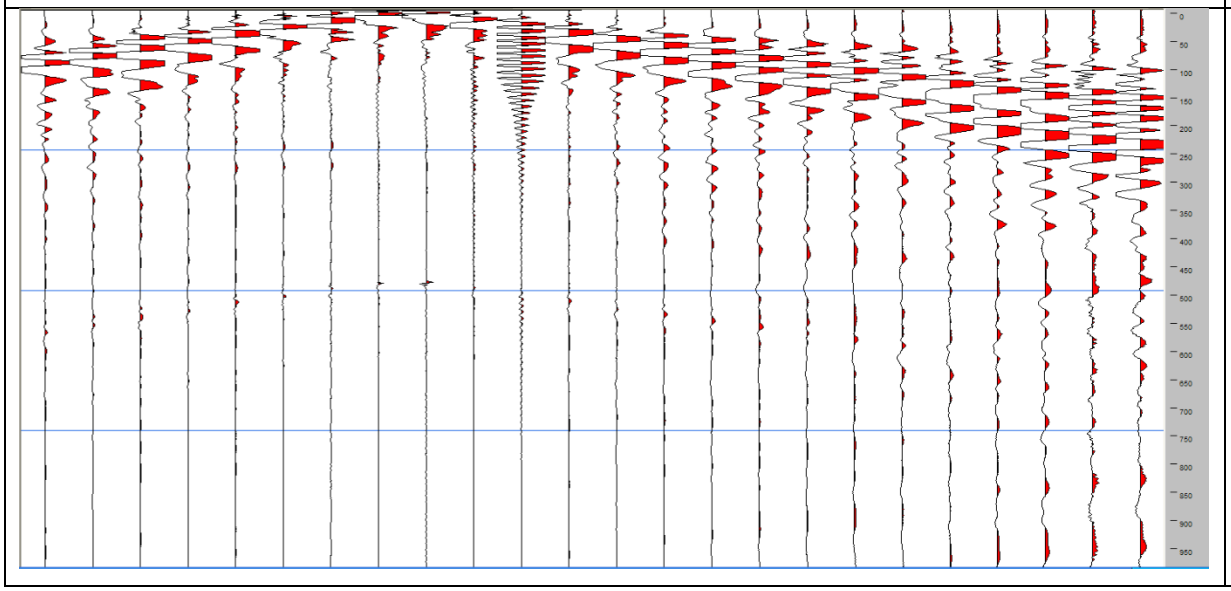
Sismogrammi onde P



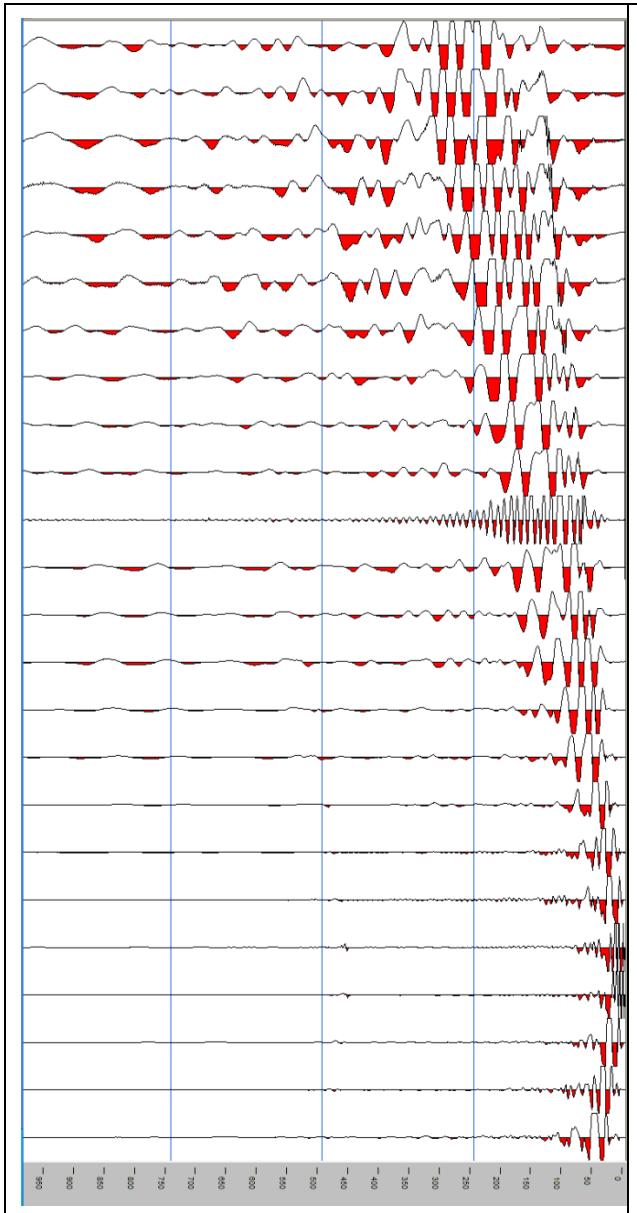
SP1



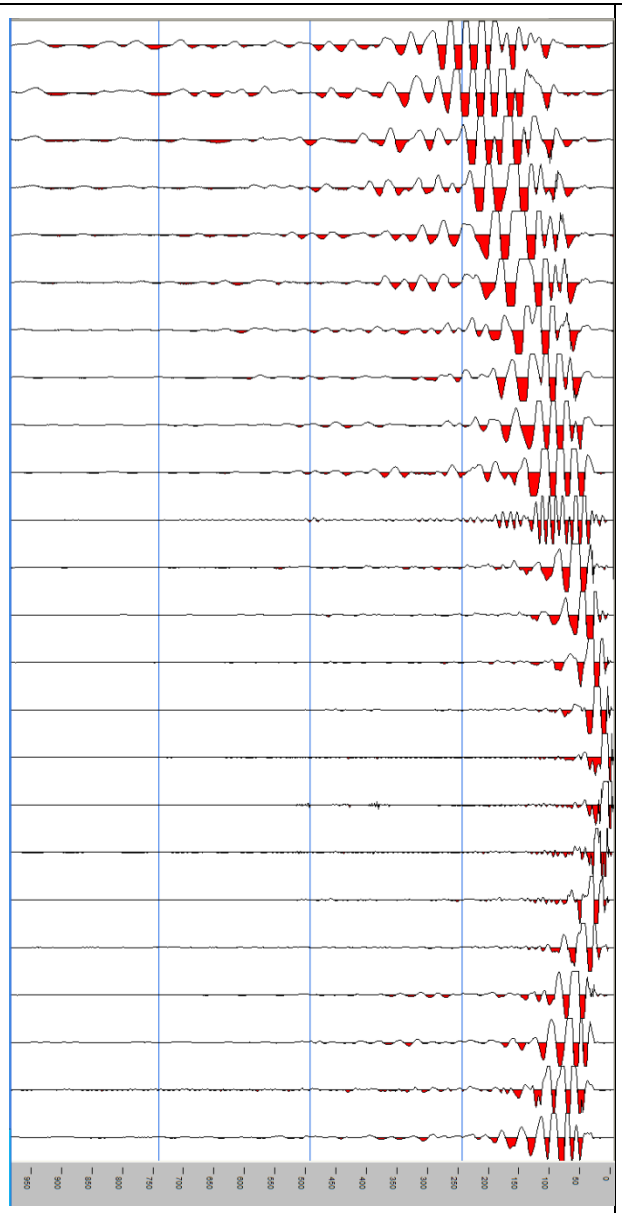
SP2



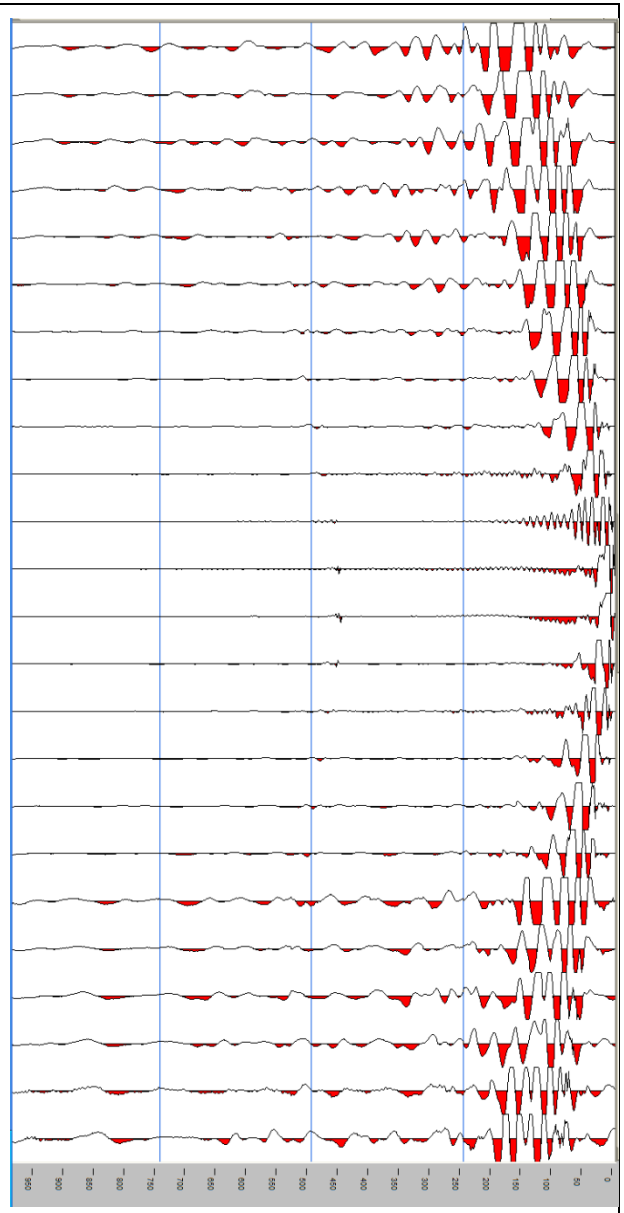
SP3



SP6



SP5



SP4

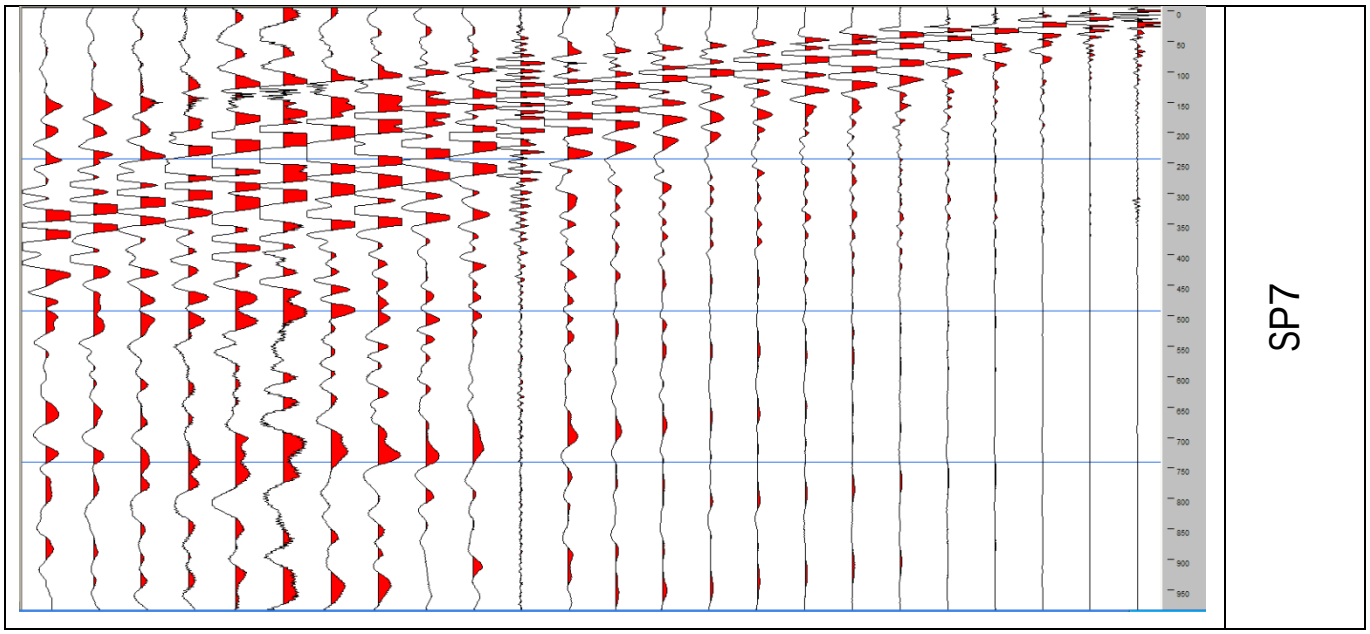
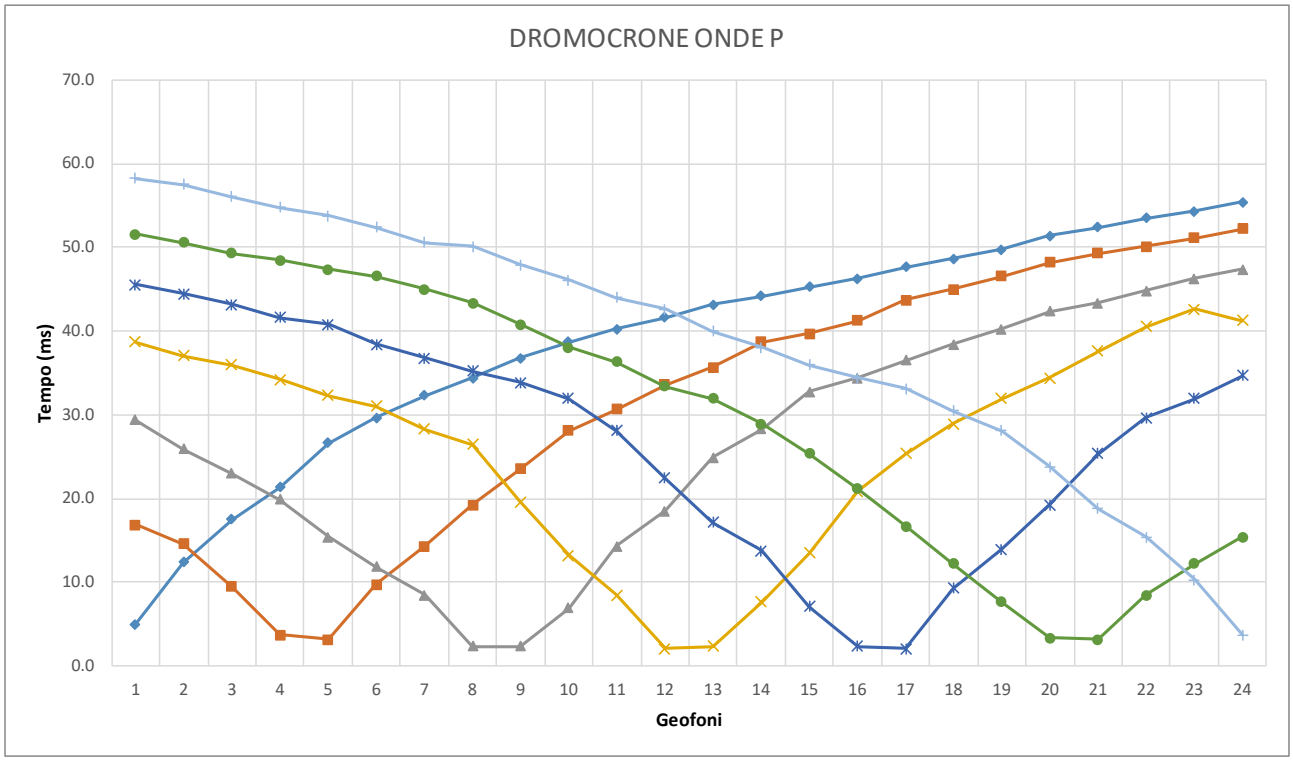
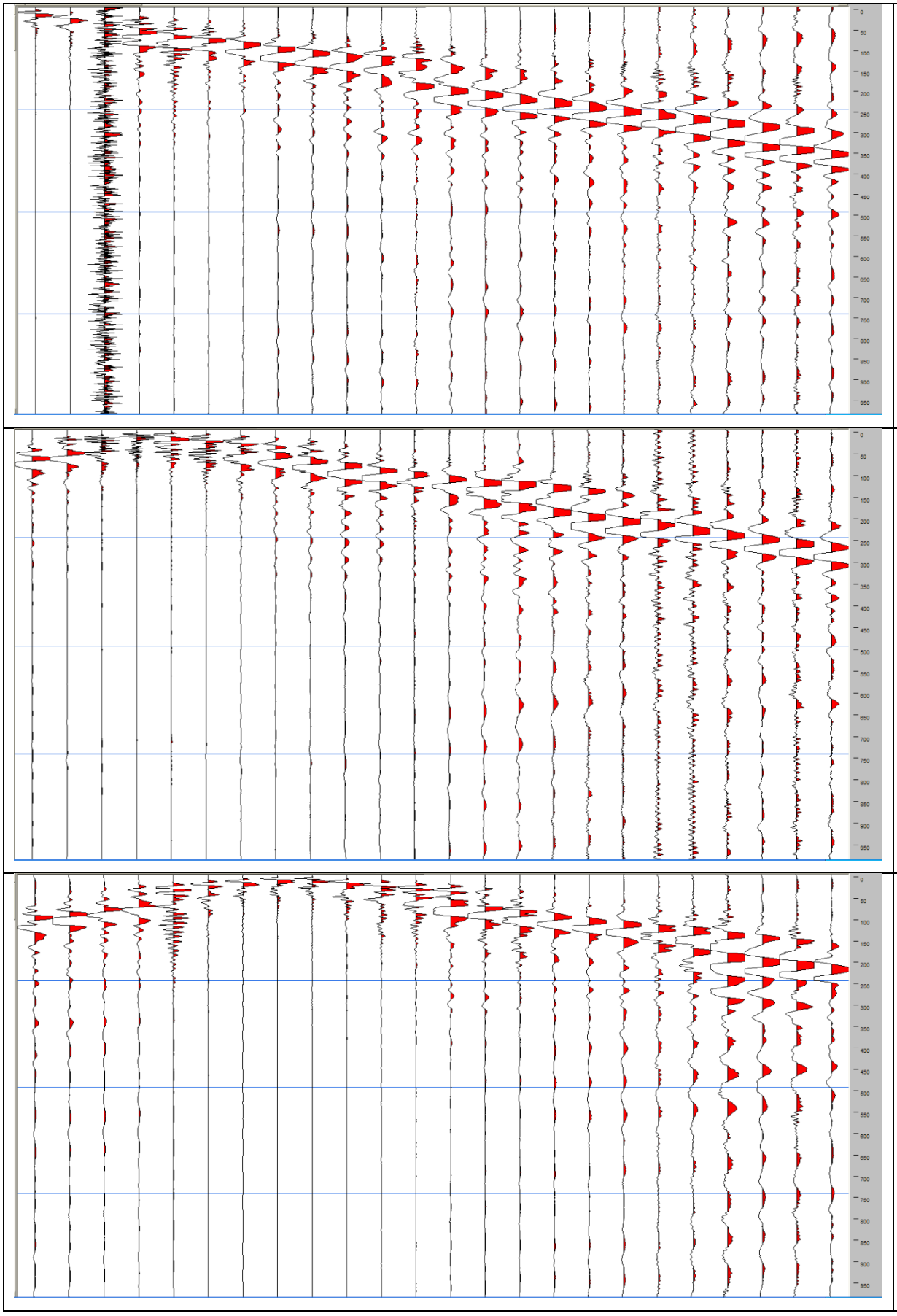


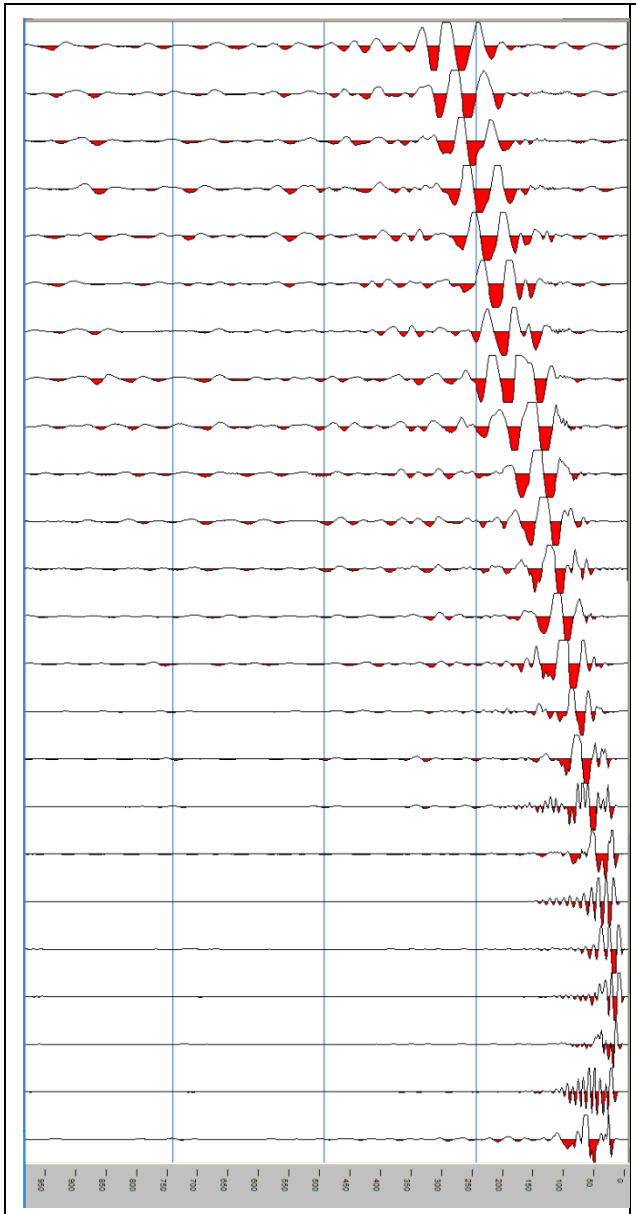
Tabella geometria e tempi onde P

ONDE P				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	5.0	12.4	17.5	21.4	26.7	29.7	32.3	34.4	36.8	38.7	40.3	41.6	43.2	44.2	45.3	46.3	47.7	48.7	49.8	51.4	52.4	53.5	54.3	55.4	Tempo (ms)
	Quota (m)	151.0																										
S2	Progressiva (m)	11.25	PS2	16.9	14.6	9.5	3.7	3.2	9.8	14.3	19.3	23.6	28.1	30.7	33.6	35.7	38.7	39.7	41.3	43.7	45.0	46.6	48.2	49.3	50.1	51.1	52.2	
	Quota (m)	151.0																										
S3	Progressiva (m)	21.25	PS3	29.4	25.9	23.0	19.9	15.4	11.9	8.5	2.4	2.4	6.9	14.3	18.5	24.9	28.3	32.8	34.4	36.5	38.4	40.3	42.4	43.4	44.8	46.3	47.4	
	Quota (m)	151.0																										
S4	Progressiva (m)	31.25	PS4	38.7	37.1	36.0	34.2	32.3	31.0	28.3	26.5	19.6	13.2	8.5	2.1	2.4	7.7	13.5	20.9	25.4	28.9	32.0	34.4	37.6	40.5	42.6	41.3	
	Quota (m)	151.0																										
S5	Progressiva (m)	41.25	PS5	45.6	44.5	43.2	41.6	40.8	38.4	36.8	35.2	33.9	32.0	28.1	22.5	17.2	13.8	7.1	2.4	2.1	9.3	14.0	19.3	25.4	29.7	32.0	34.7	
	Quota (m)	151.0																										
S6	Progressiva (m)	51.25	PS6	51.6	50.6	49.3	48.5	47.4	46.6	45.0	43.4	40.8	38.1	36.3	33.4	32.0	28.9	25.4	21.2	16.7	12.2	7.7	3.4	3.2	8.5	12.2	15.4	
	Quota (m)	151.0																										
S7	Progressiva (m)	61.25	PS7	58.3	57.5	56.1	54.8	53.8	52.4	50.6	50.1	47.9	46.1	44.0	42.6	40.0	38.1	36.0	34.4	33.1	30.5	28.1	23.8	18.8	15.4	10.3	3.7	
	Quota (m)	151.0																										

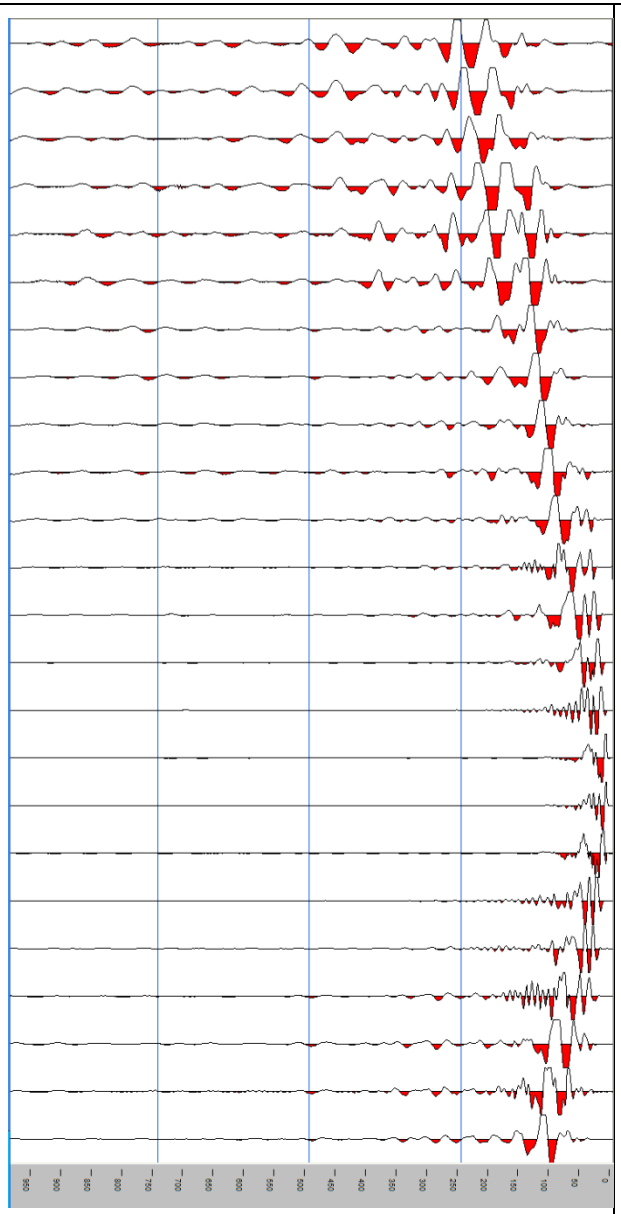


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

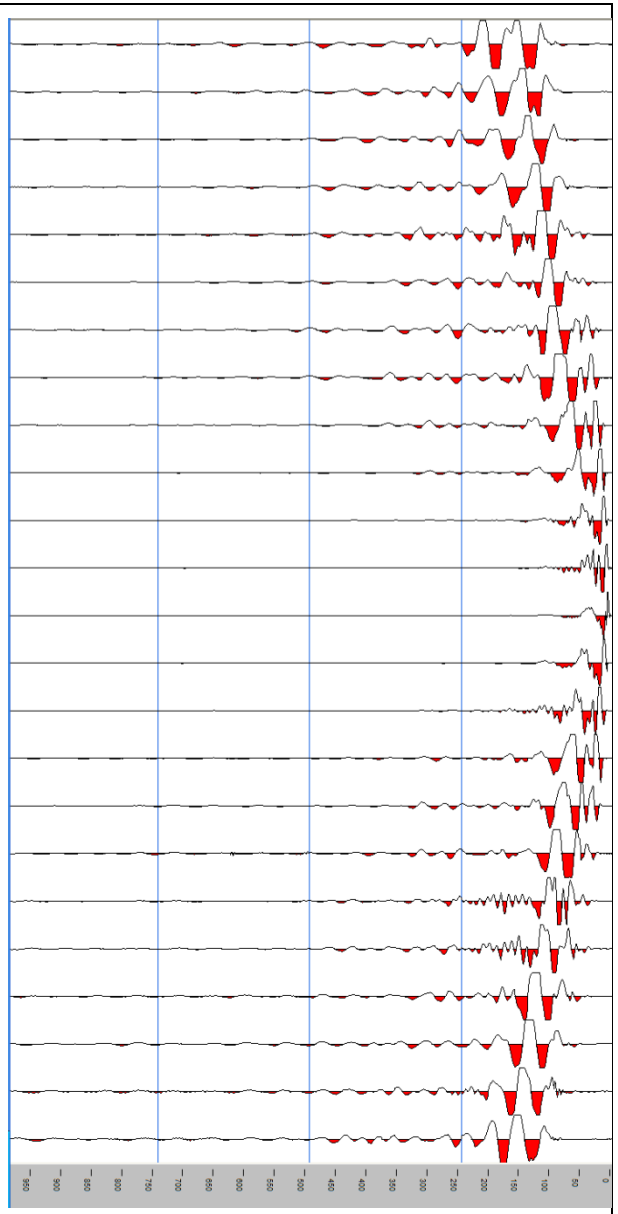




SP6



SP5



SP4

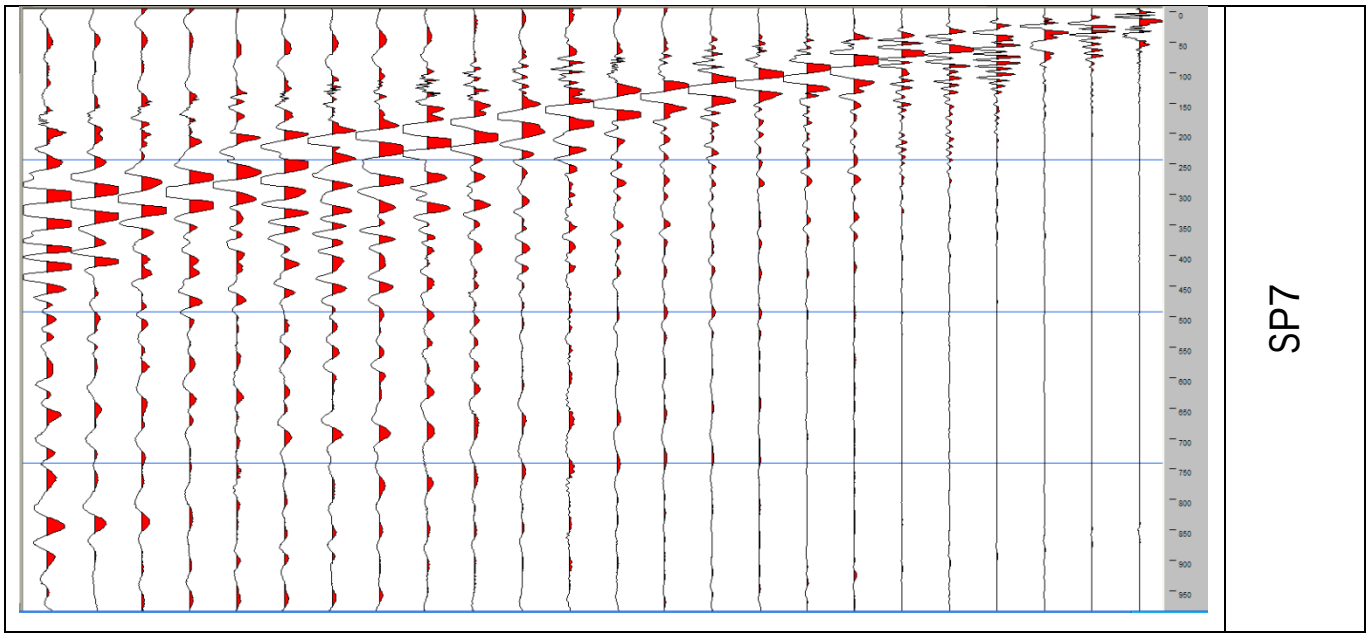
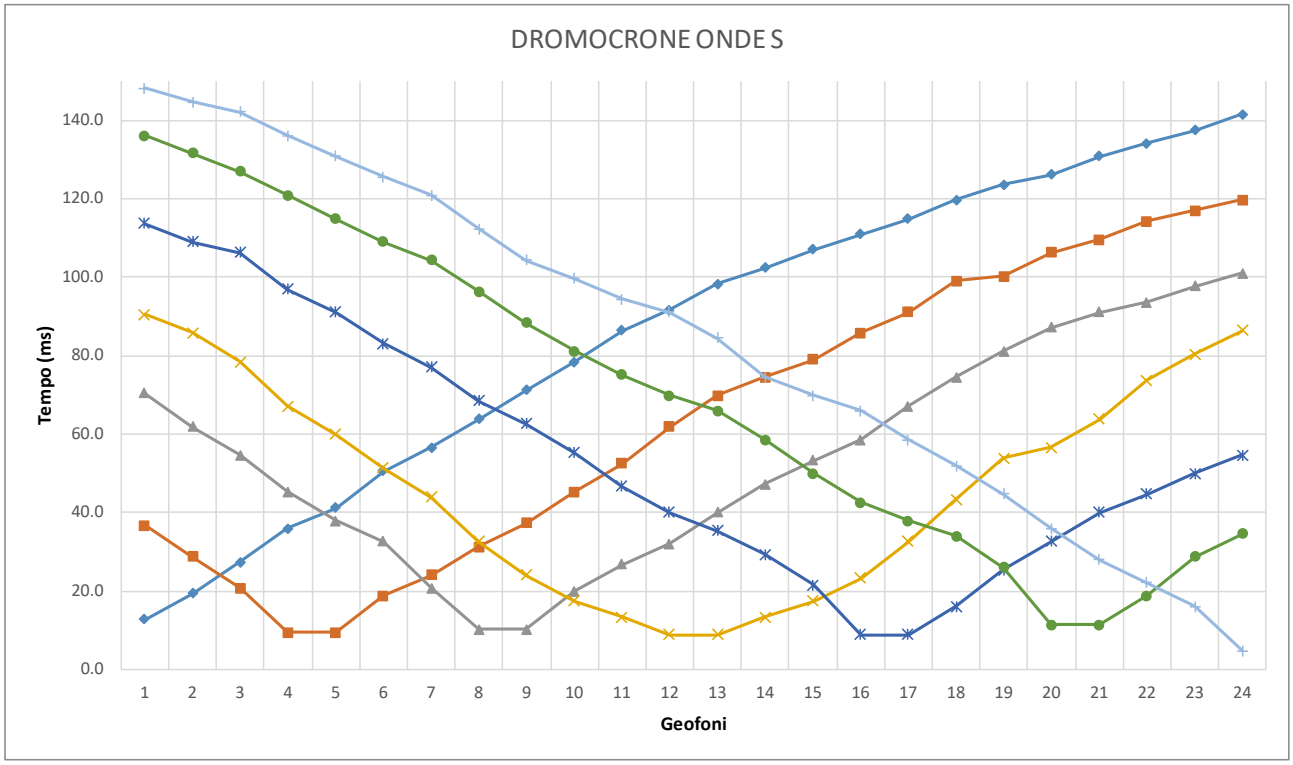


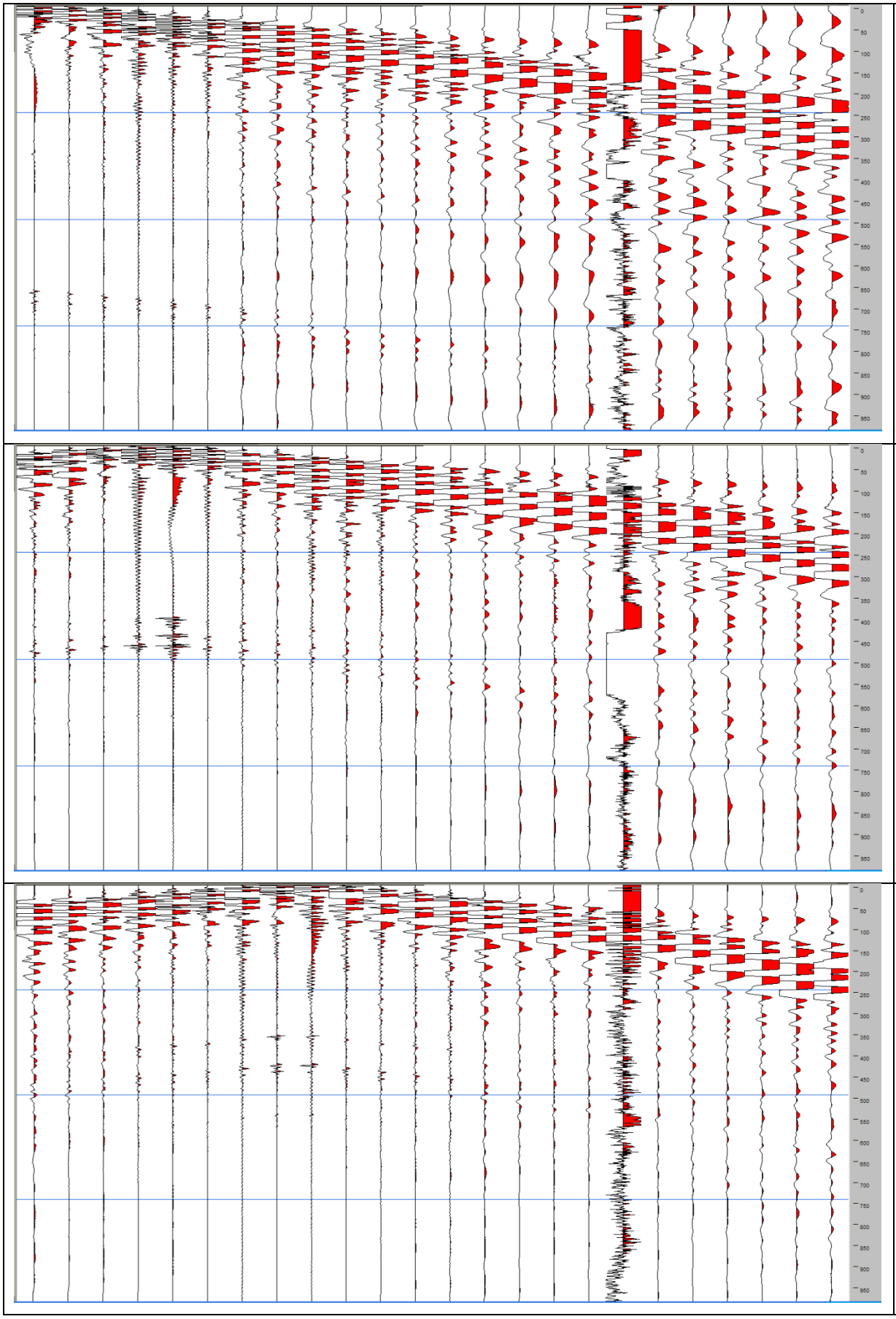
Tabella geometria e tempi onde S

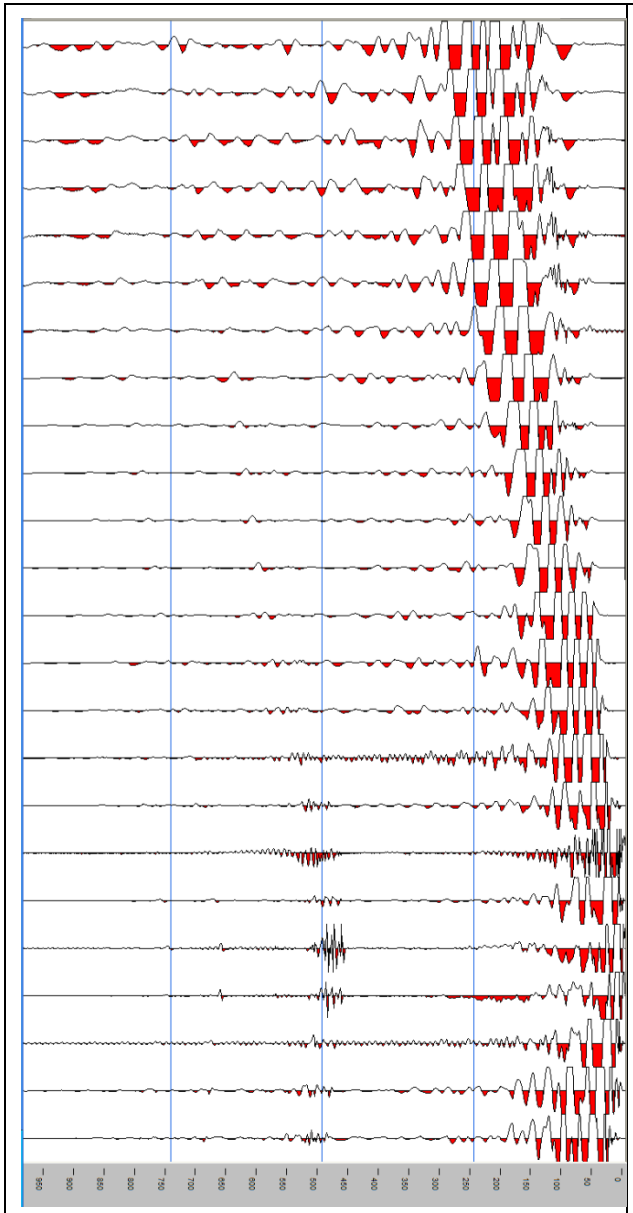
ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	151.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	12.8	19.5	27.4	36.0	41.3	50.6	56.6	63.9	71.2	78.5	86.4	91.7	98.3	102.3	107.0	110.9	114.9	119.6	123.5	126.2	130.8	134.1	137.4	141.4	Tempo (ms)
	Quota (m)	151.0																										
S2	Progressiva (m)	11.25	PS2	36.7	28.8	20.8	9.5	9.5	18.8	24.1	31.4	37.4	45.3	52.6	61.9	69.8	74.5	79.1	85.8	91.1	99.0	100.3	106.3	109.6	114.3	116.9	119.6	
	Quota (m)	151.0																										
S3	Progressiva (m)	21.25	PS3	70.5	61.9	54.6	45.3	38.0	32.7	20.8	10.2	10.2	20.1	26.8	32.1	40.0	47.3	53.3	58.6	67.2	74.5	81.1	87.1	91.1	93.7	97.7	101.0	
	Quota (m)	151.0																										
S4	Progressiva (m)	31.25	PS4	90.4	85.8	78.5	67.2	59.9	51.3	44.0	32.7	24.1	17.5	13.5	8.9	8.9	13.5	17.5	23.4	32.7	43.3	53.9	56.6	63.9	73.8	80.4	86.4	
	Quota (m)	151.0																										
S5	Progressiva (m)	41.25	PS5	113.6	108.9	106.3	97.0	91.1	83.1	77.1	68.5	62.6	55.3	46.6	40.0	35.4	29.4	21.5	8.9	8.9	16.2	25.4	32.7	40.0	44.7	50.0	54.6	
	Quota (m)	151.0																										
S6	Progressiva (m)	51.25	PS6	136.1	131.5	126.8	120.9	114.9	108.9	104.3	96.4	88.4	81.1	75.1	69.8	65.9	58.6	50.0	42.7	38.0	34.1	26.1	11.5	11.5	18.8	28.8	34.7	
	Quota (m)	151.0																										
S7	Progressiva (m)	61.25	PS7	148.1	144.7	142.1	136.1	130.8	125.5	120.9	112.3	104.3	99.7	94.4	91.1	84.4	74.5	69.8	65.9	58.6	51.9	44.7	36.0	28.1	22.1	16.2	4.9	
	Quota (m)	151.0																										



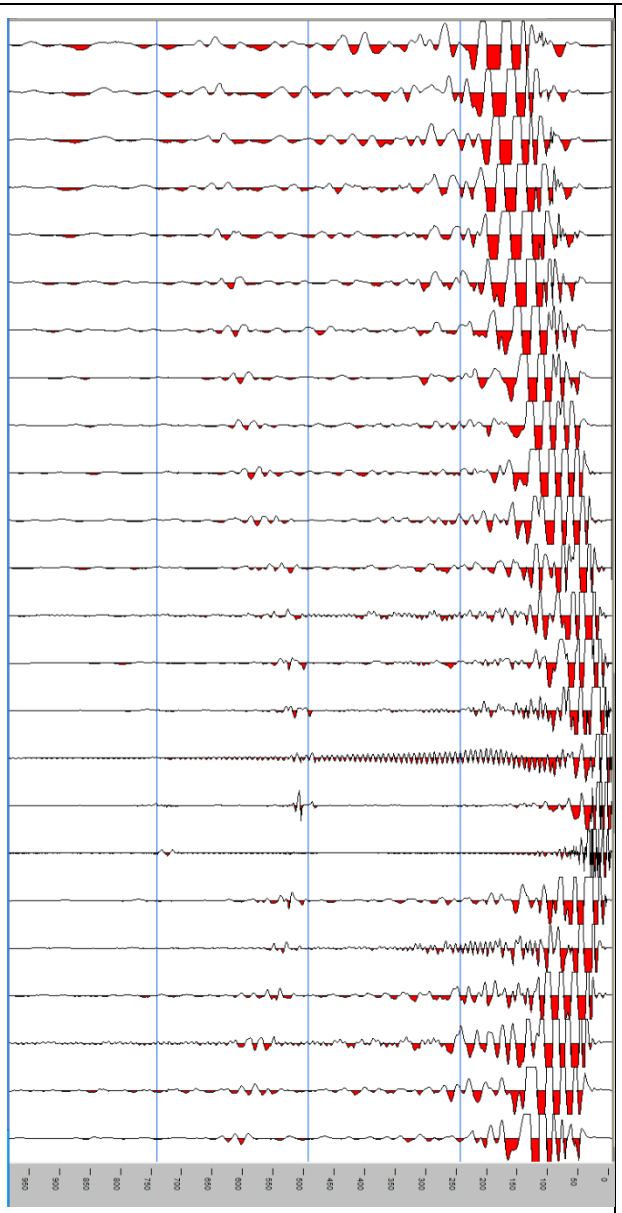
PROFILO SISMICO N

Sismogrammi onde P

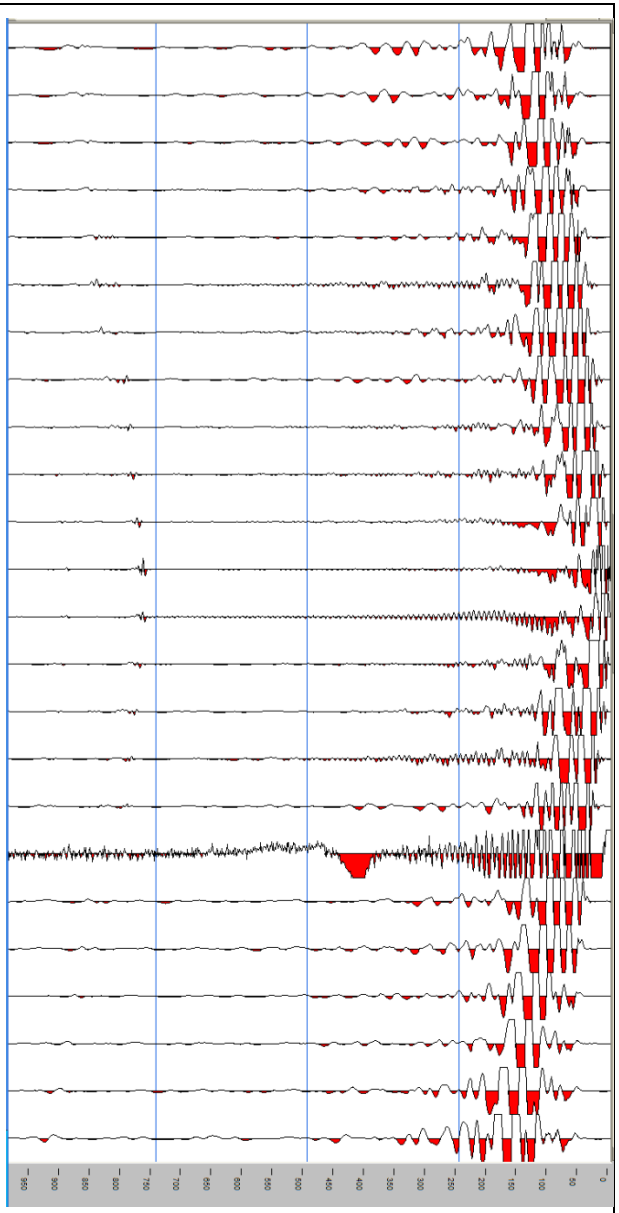




SP6



SP5



SP4

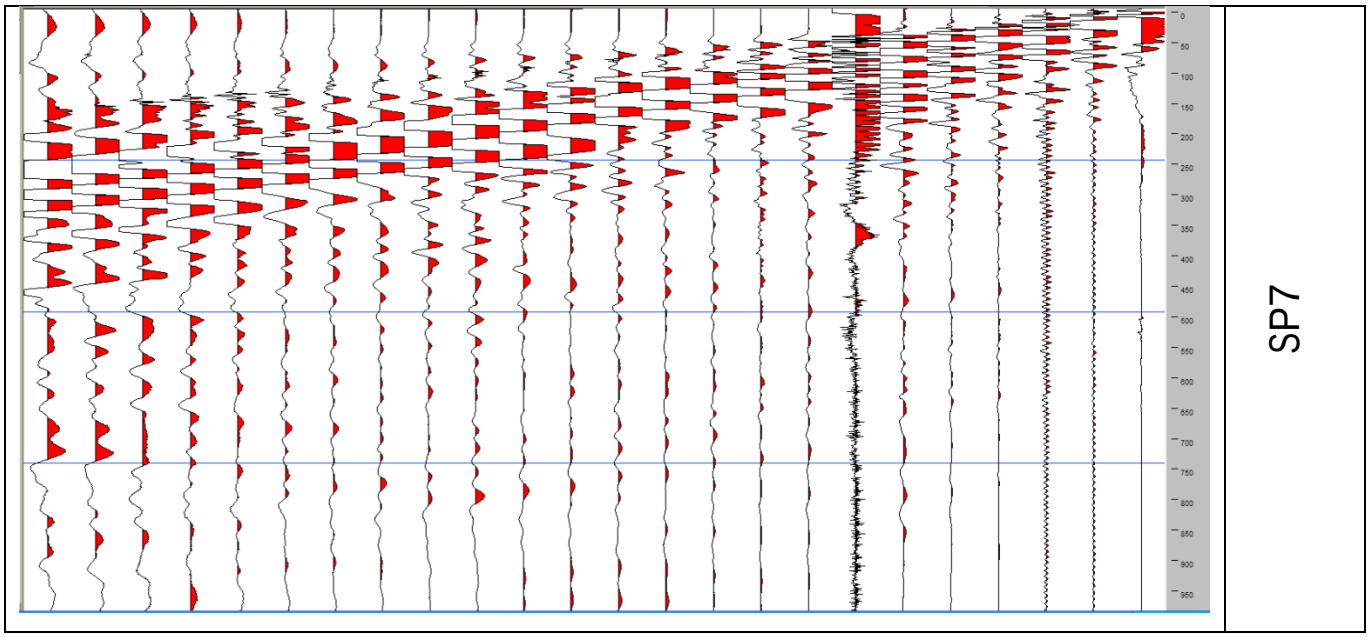
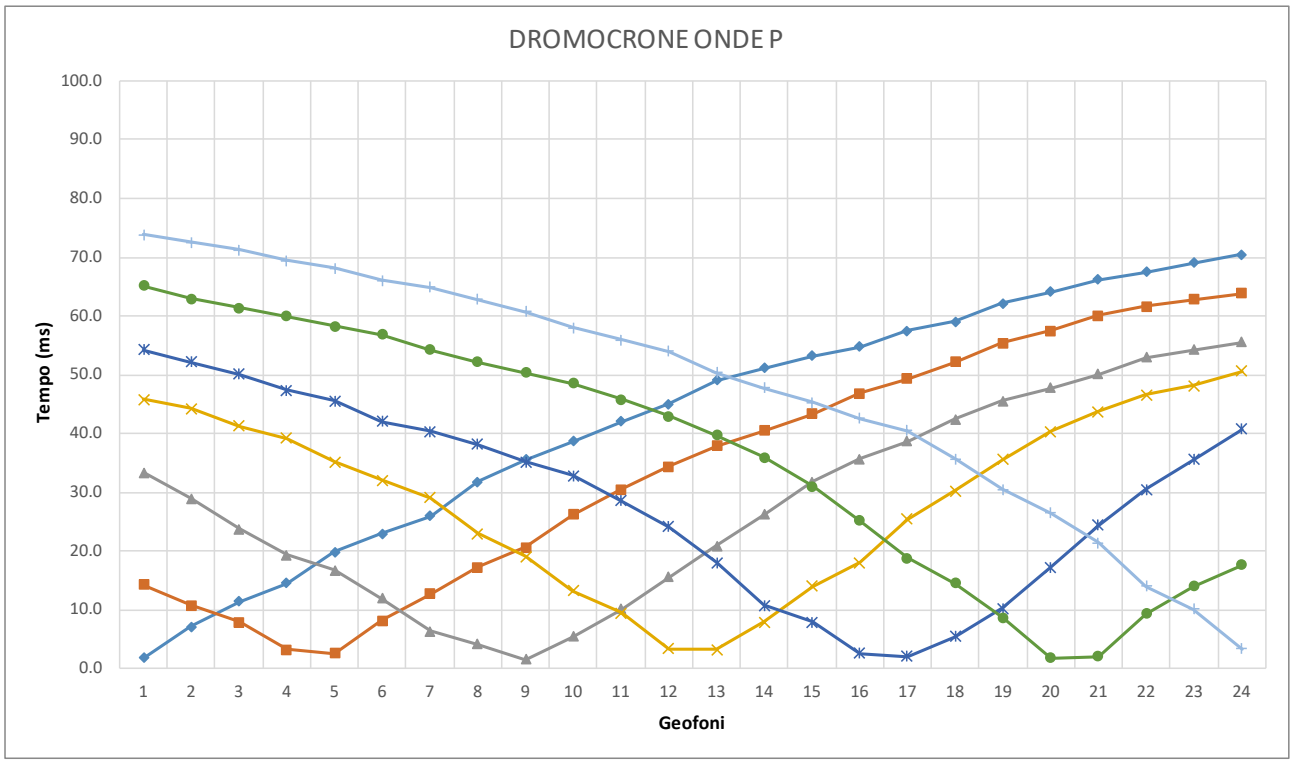
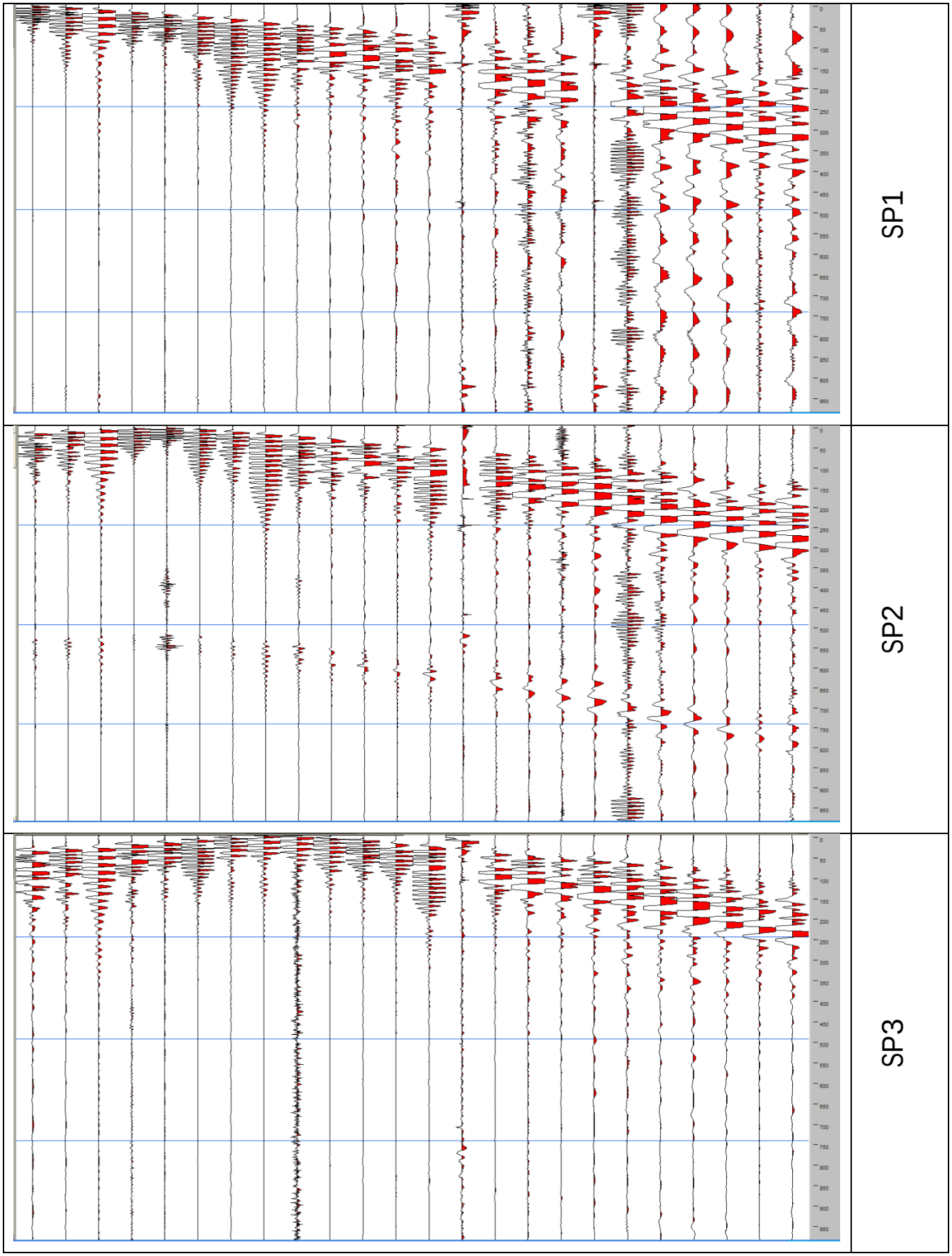


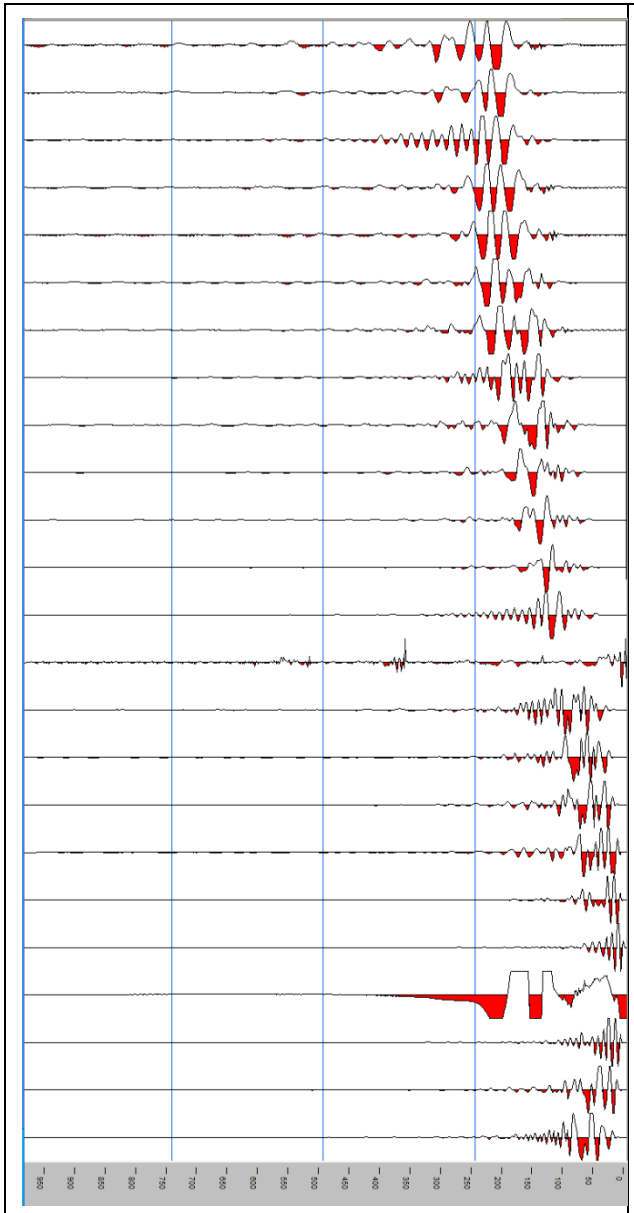
Tabella geometria e tempi onde P

ONDE P				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	1.8	7.1	11.4	14.6	19.9	23.0	25.9	31.8	35.5	38.7	42.1	45.0	49.0	51.1	53.2	54.8	57.5	59.1	62.2	64.1	66.2	67.5	69.1	70.5	Tempo (ms)
	Quota (m)	146.0																										
S2	Progressiva (m)	11.25	PS2	14.3	10.8	7.9	3.2	2.6	8.2	12.7	17.2	20.6	26.2	30.5	34.4	37.9	40.5	43.4	46.9	49.3	52.2	55.4	57.5	60.1	61.7	62.8	63.8	
	Quota (m)	146.0																										
S3	Progressiva (m)	21.25	PS3	33.4	28.9	23.8	19.3	16.7	11.9	6.3	4.2	1.6	5.5	10.1	15.6	20.9	26.2	31.8	35.7	38.7	42.4	45.6	47.7	50.1	53.0	54.3	55.6	
	Quota (m)	146.0																										
S4	Progressiva (m)	31.25	PS4	45.8	44.2	41.3	39.2	35.2	32.0	29.1	23.0	19.1	13.2	9.5	3.4	3.2	7.9	14.0	18.0	25.4	30.2	35.5	40.3	43.7	46.6	48.2	50.6	
	Quota (m)	146.0																										
S5	Progressiva (m)	41.25	PS5	54.3	52.2	50.1	47.4	45.6	42.1	40.3	38.1	35.2	32.8	28.6	24.1	18.0	10.8	7.9	2.6	2.1	5.5	10.3	17.2	24.4	30.5	35.5	40.8	
	Quota (m)	146.0																										
S6	Progressiva (m)	51.25	PS6	65.2	63.0	61.4	59.9	58.3	56.9	54.3	52.2	50.3	48.5	45.8	42.9	39.7	36.0	31.0	25.2	18.8	14.6	8.7	1.8	2.1	9.3	14.0	17.7	
	Quota (m)	146.0																										
S7	Progressiva (m)	61.25	PS7	73.9	72.6	71.2	69.4	68.1	66.0	64.9	62.8	60.7	58.0	55.9	54.0	50.3	47.7	45.3	42.6	40.5	35.7	30.5	26.5	21.4	14.0	10.1	3.4	
	Quota (m)	146.0																										

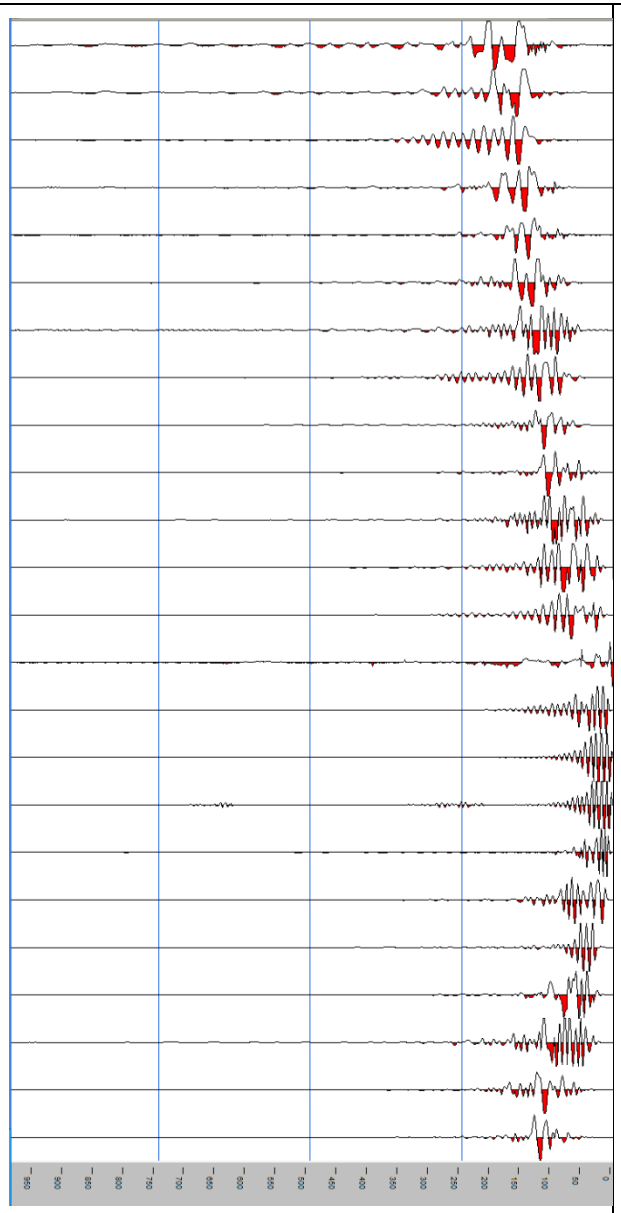


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

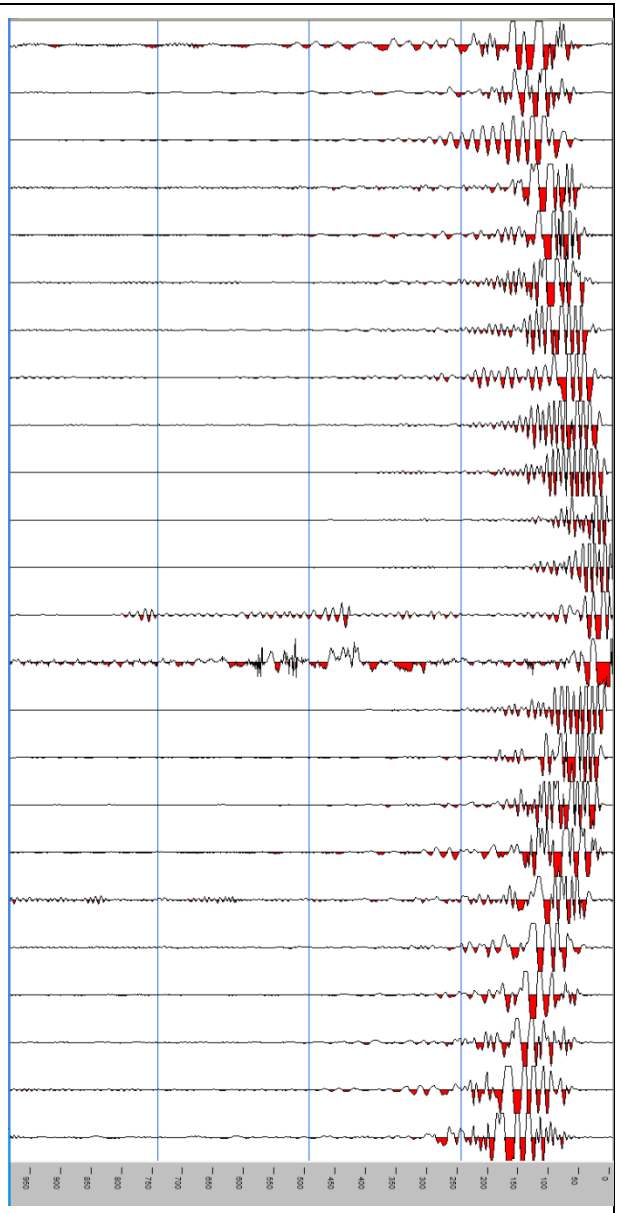




SP6



SP5



SP4

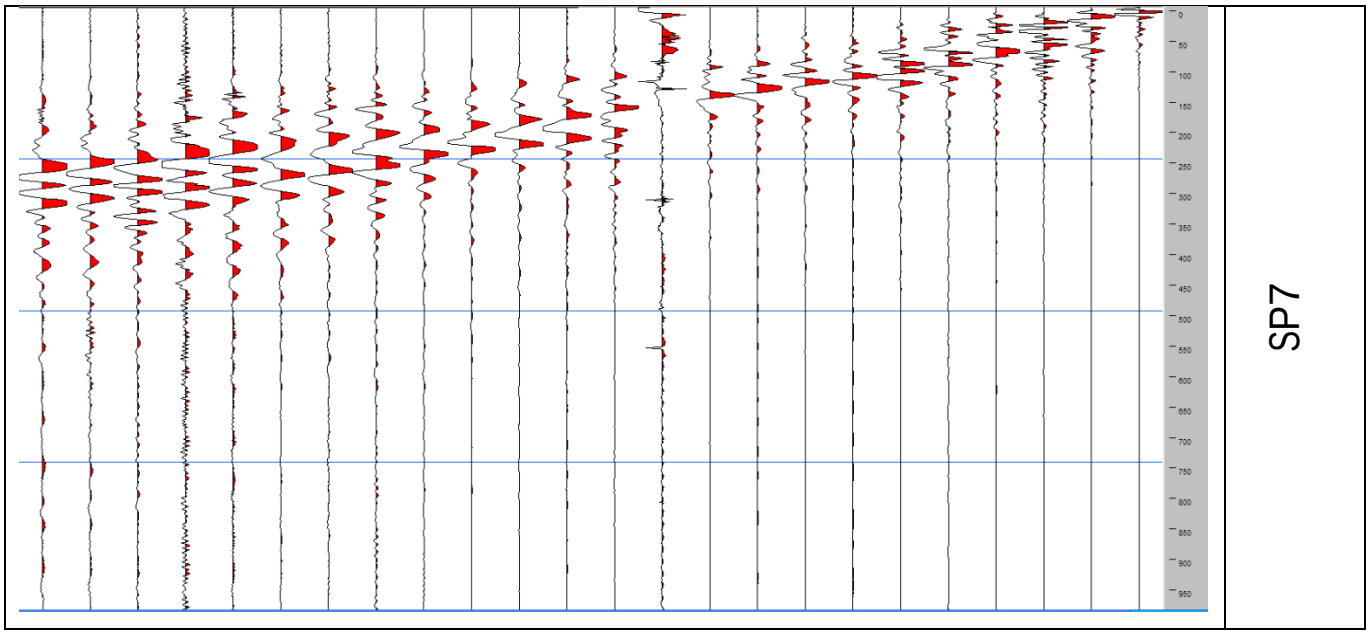
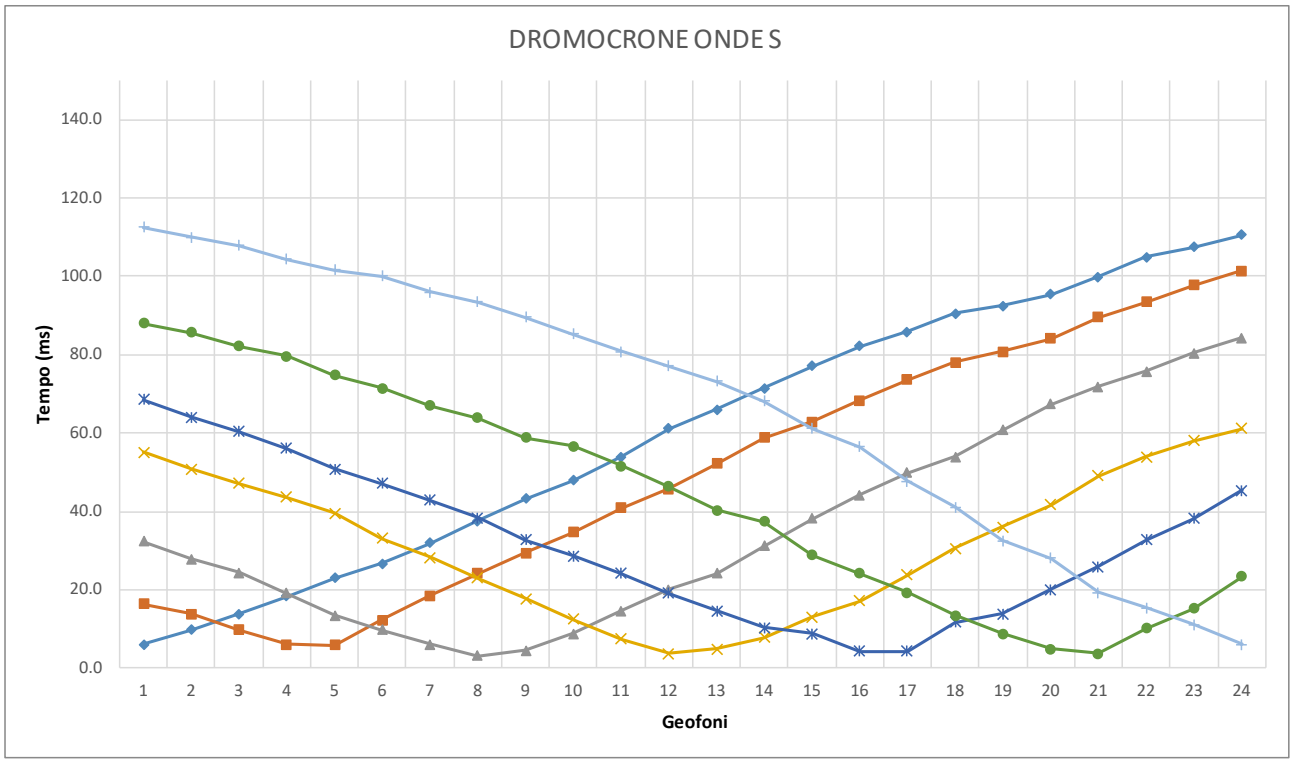


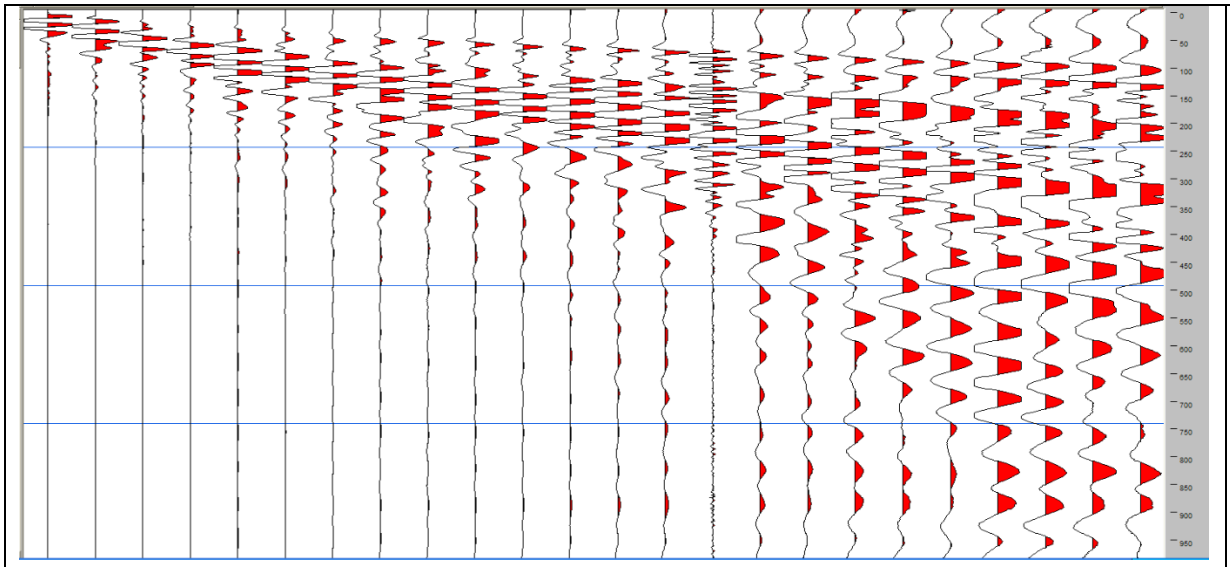
Tabella geometria e tempi onde S

ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	6.1	9.8	13.8	18.3	23.0	26.7	32.0	37.6	43.2	47.9	54.0	61.2	66.0	71.5	77.1	82.1	85.8	90.6	92.4	95.4	99.9	104.9	107.5	110.5	Tempo (ms)
	Quota (m)	146.0																										
S2	Progressiva (m)	11.25	PS2	16.4	13.8	9.8	6.1	5.8	12.2	18.5	24.1	29.4	34.7	40.8	45.8	52.2	58.8	62.8	68.3	73.6	78.1	80.8	84.0	89.5	93.5	97.7	101.4	
	Quota (m)	146.0																										
S3	Progressiva (m)	21.25	PS3	32.3	27.8	24.4	19.1	13.5	9.8	6.1	3.2	4.5	8.7	14.6	20.1	24.1	31.2	38.1	44.2	49.8	54.0	60.7	67.3	71.8	75.8	80.3	84.2	
	Quota (m)	146.0																										
S4	Progressiva (m)	31.25	PS4	55.1	50.8	47.1	43.7	39.5	33.1	28.3	23.0	17.7	12.4	7.4	3.7	4.8	7.7	13.0	17.2	23.8	30.5	36.0	41.6	49.0	54.0	58.0	61.2	
	Quota (m)	146.0																										
S5	Progressiva (m)	41.25	PS5	68.6	64.1	60.4	56.1	50.8	47.1	42.9	38.4	32.8	28.6	24.1	19.1	14.6	10.3	8.7	4.2	4.2	11.6	13.8	20.1	25.9	32.8	38.1	45.3	
	Quota (m)	146.0																										
S6	Progressiva (m)	51.25	PS6	87.9	85.6	82.1	79.7	74.7	71.5	67.0	63.8	58.8	56.7	51.6	46.3	40.3	37.3	28.9	24.1	19.3	13.5	8.7	4.8	3.7	10.1	15.1	23.3	
	Quota (m)	146.0																										
S7	Progressiva (m)	61.25	PS7	112.6	109.9	107.8	104.4	101.7	100.1	95.9	93.5	89.5	85.3	80.8	77.1	73.1	68.1	61.2	56.4	47.7	41.0	32.6	28.1	19.3	15.4	11.1	6.1	
	Quota (m)	146.0																										

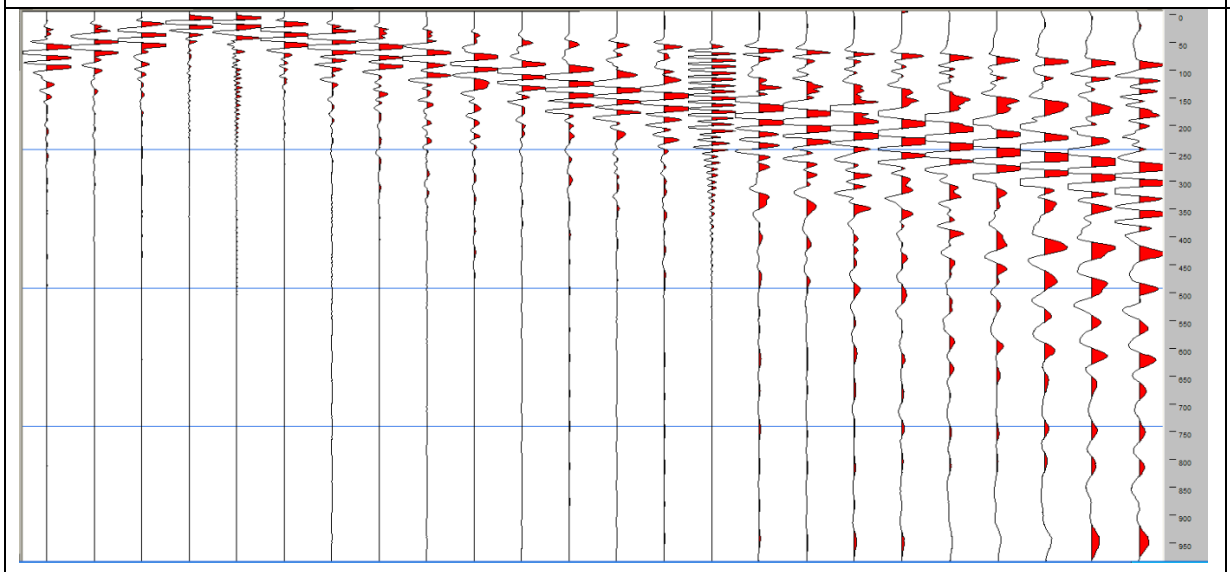


PROFILO SISMICO O

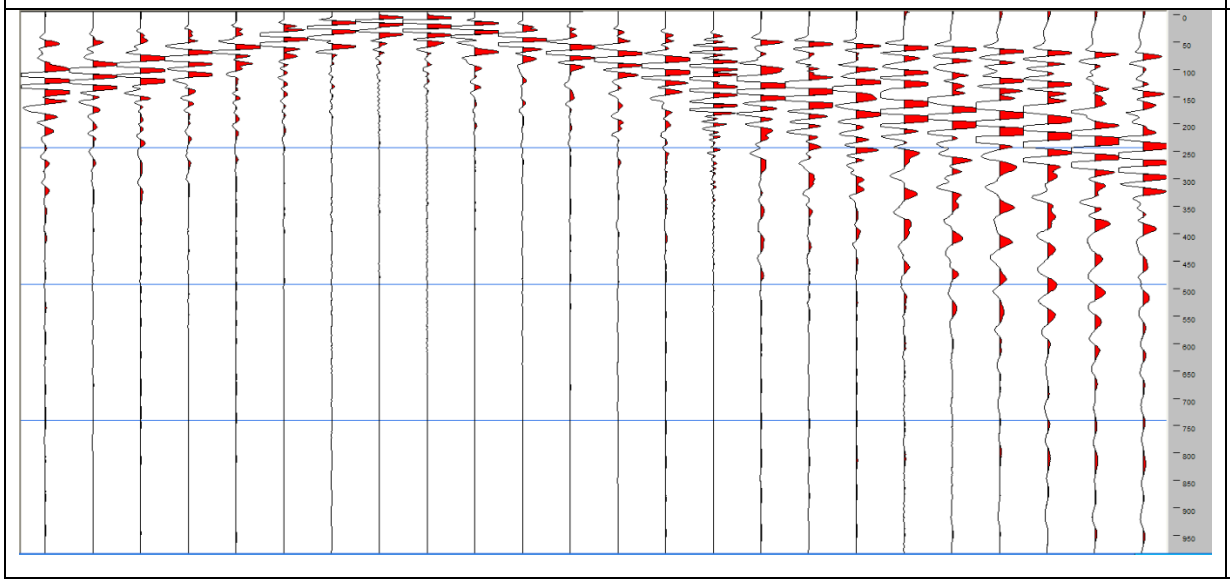
Sismogrammi onde P



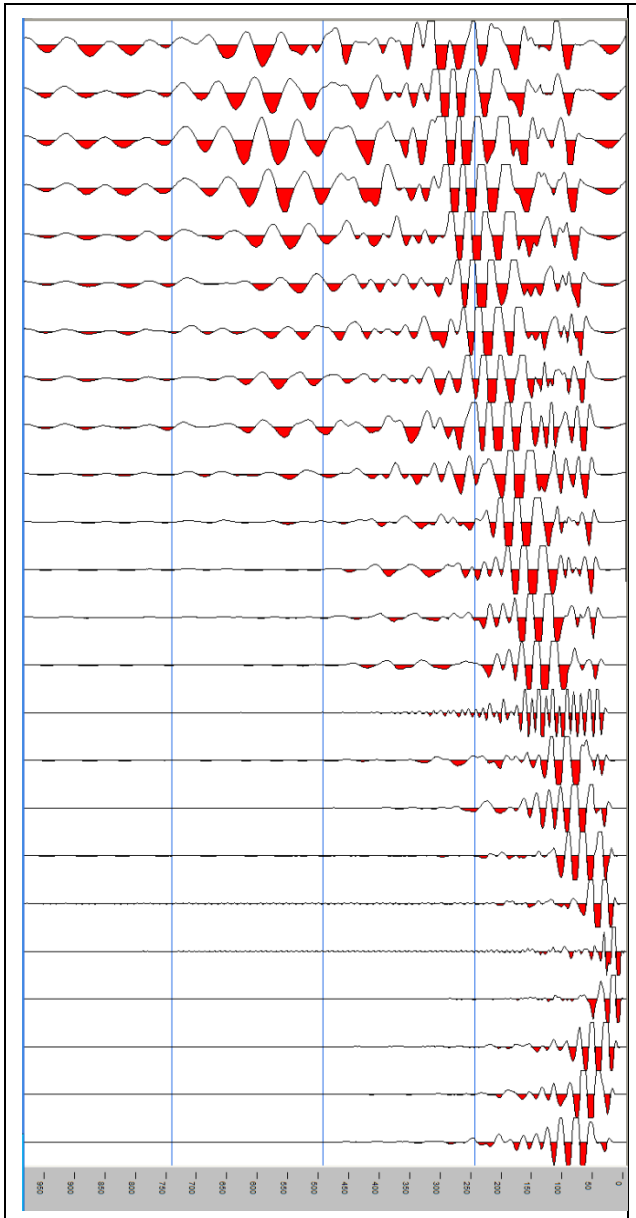
SP1



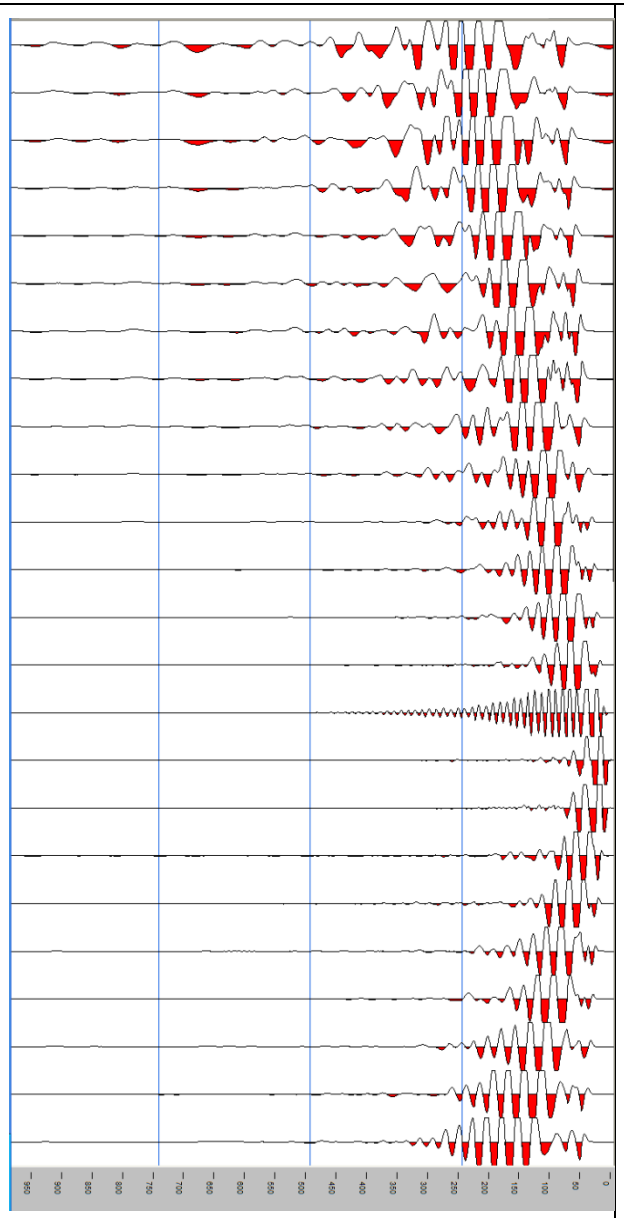
SP2



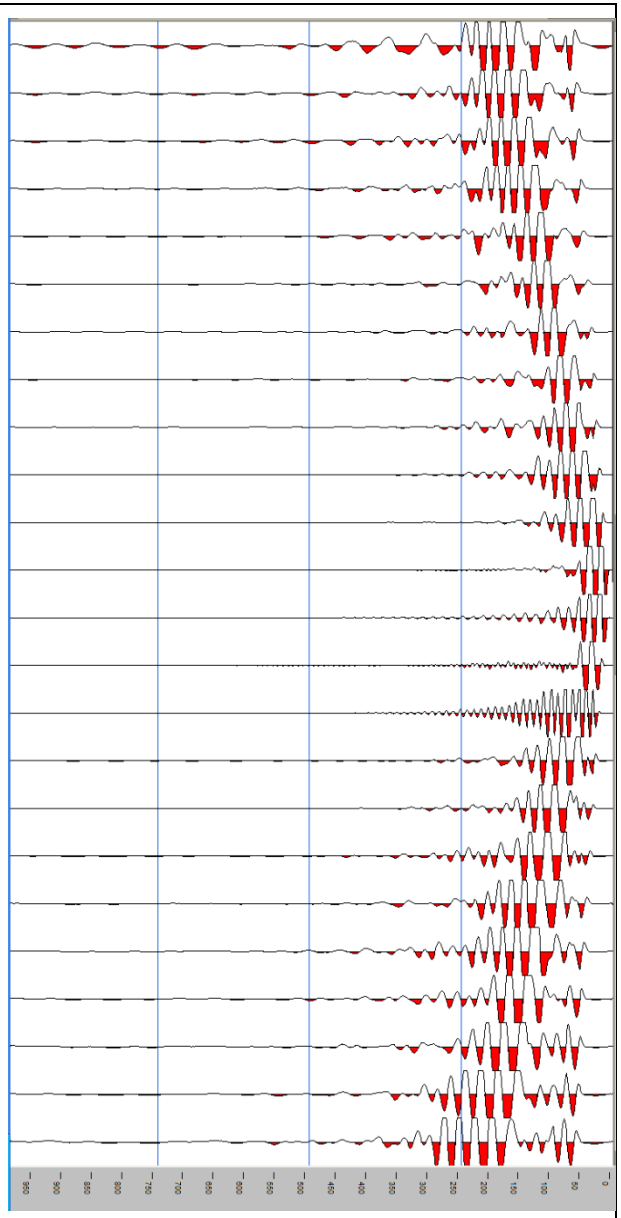
SP3



SP6



SP5



SP4

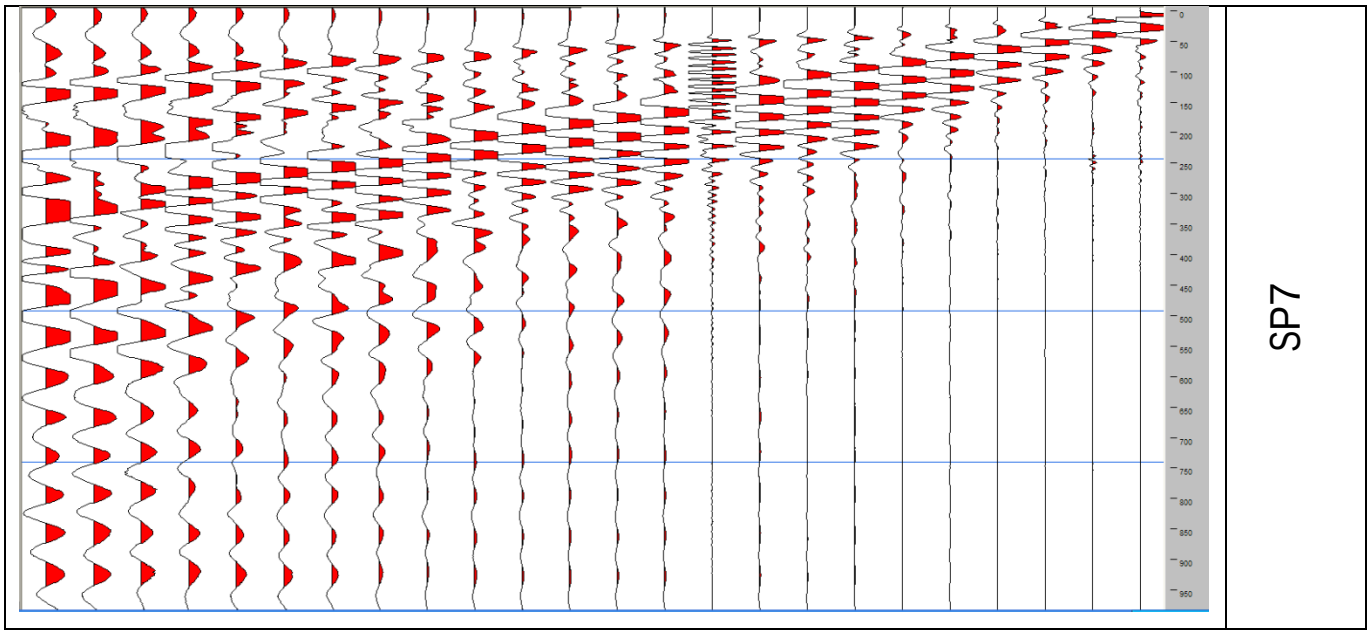
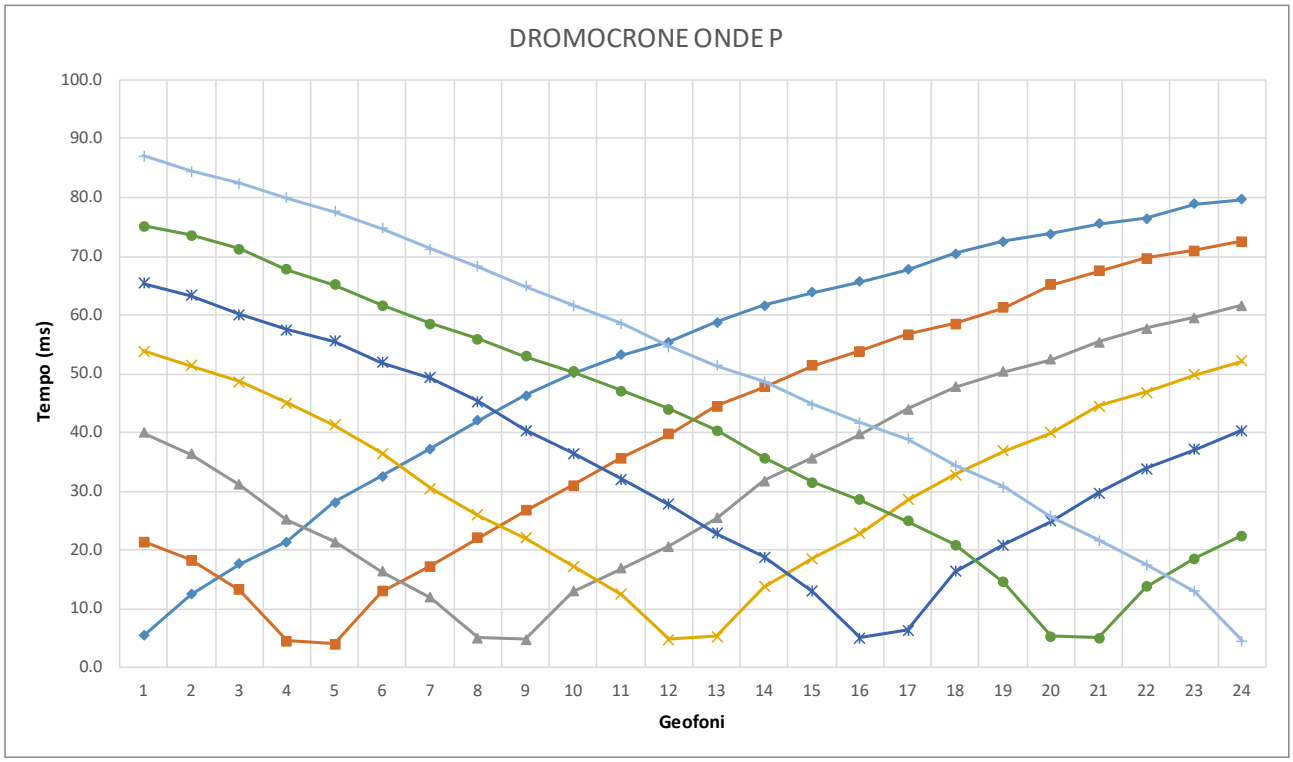
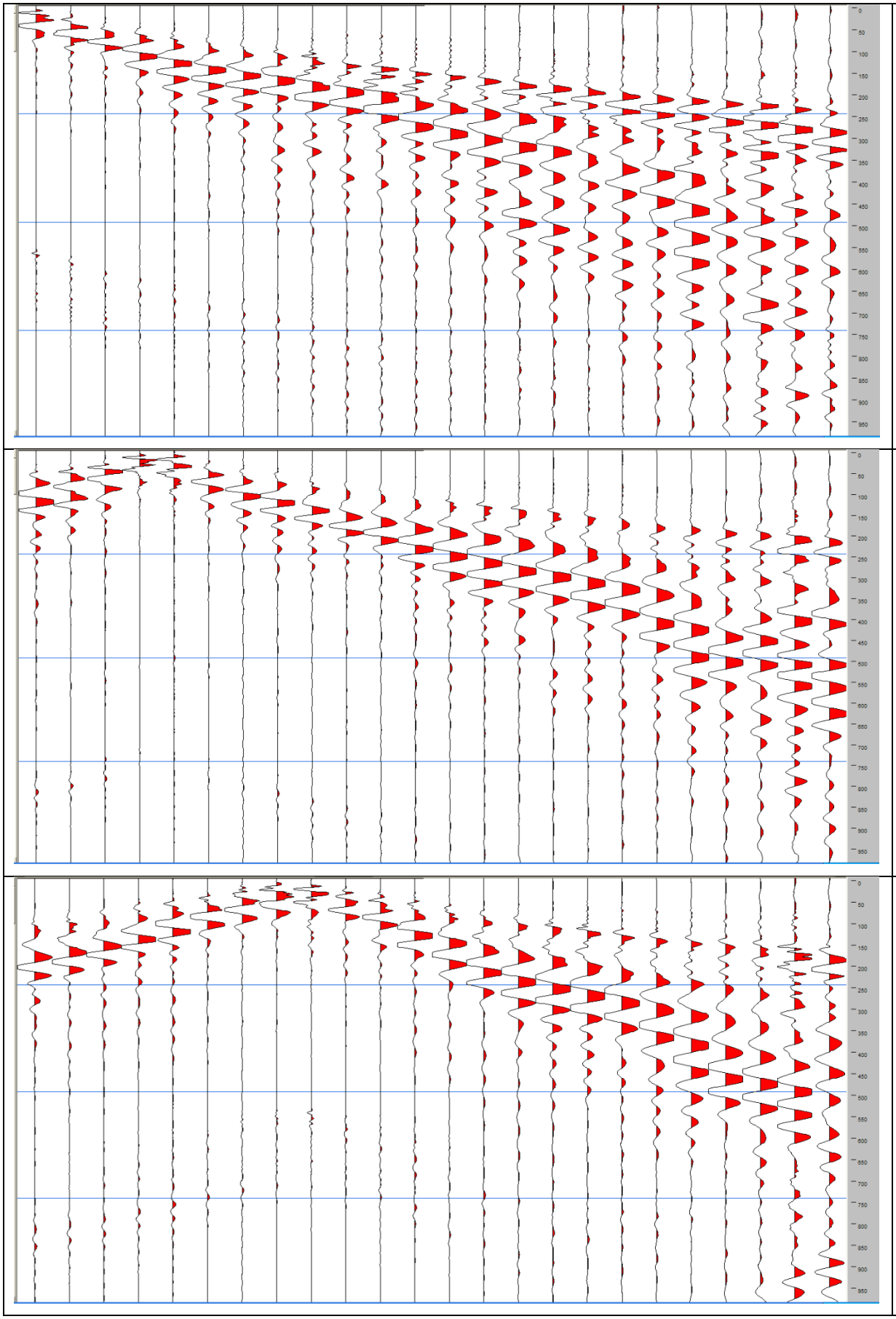


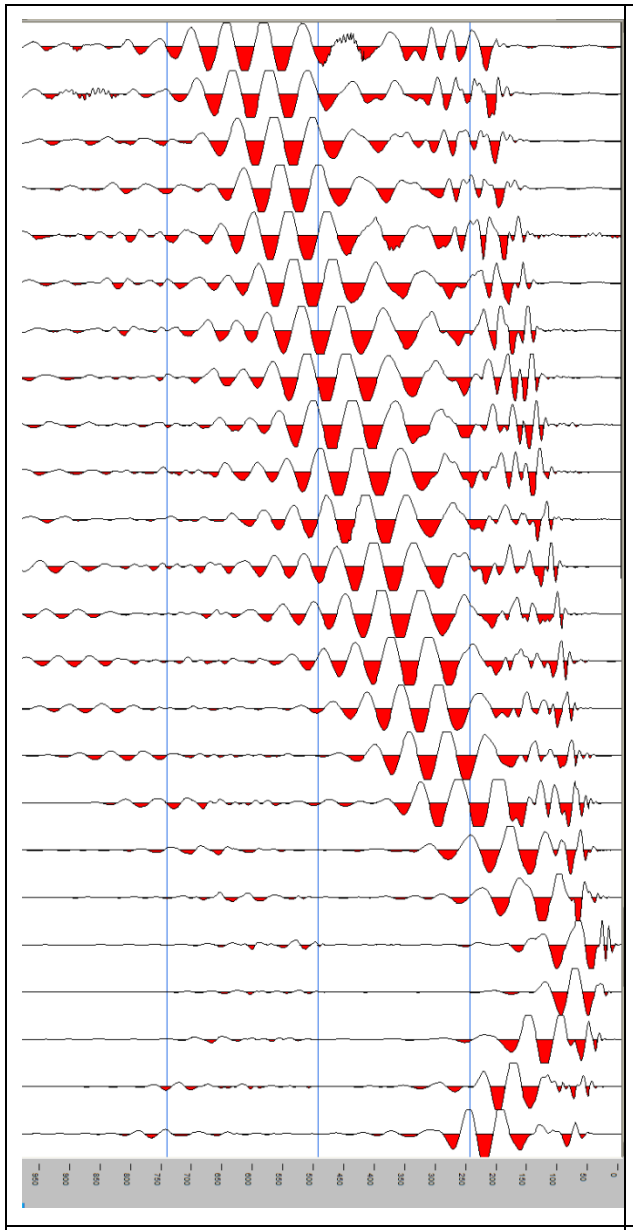
Tabella geometria e tempi onde P

ONDE P				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				18.88	21.37	23.86	26.36	28.85	31.34	33.83	36.32	38.8	41.29	43.77	46.26	48.74	51.23	53.72	56.2	58.69	61.17	63.66	66.14	68.63	71.12	73.6	76.09	Progressiva (m)
				169.9	169.7	169.5	169.3	169.1	168.9	168.7	168.4	168.1	167.9	167.6	167.3	167.1	166.8	166.5	166.3	166.0	165.7	165.5	165.2	164.9	164.7	164.4	164.1	Quota (m)
S1	Progressiva (m)	17.63	PS1	5.5	12.4	17.7	21.4	28.1	32.6	37.3	42.1	46.3	50.1	53.2	55.4	58.8	61.7	63.8	65.7	67.8	70.5	72.6	73.9	75.5	76.5	78.9	79.7	Tempo (ms)
	Quota (m)	170.0																										
S2	Progressiva (m)	27.6	PS2	21.4	18.3	13.2	4.5	4.0	13.0	17.2	22.0	26.7	31.0	35.7	39.7	44.5	47.7	51.4	53.8	56.7	58.5	61.2	65.2	67.5	69.7	71.0	72.6	
	Quota (m)	169.2																										
S3	Progressiva (m)	37.56	PS3	40.0	36.3	31.2	25.2	21.4	16.4	11.9	5.0	4.8	13.0	16.9	20.6	25.4	31.8	35.7	39.7	44.0	47.7	50.3	52.4	55.4	57.7	59.6	61.7	
	Quota (m)	168.3																										
S4	Progressiva (m)	47.5	PS4	53.8	51.4	48.7	45.0	41.3	36.5	30.5	25.9	22.0	17.2	12.4	4.8	5.3	13.8	18.5	22.8	28.6	32.8	36.8	40.0	44.5	46.9	49.8	52.2	
	Quota (m)	167.2																										
S5	Progressiva (m)	57.44	PS5	65.4	63.3	60.1	57.5	55.6	51.9	49.3	45.3	40.3	36.5	32.0	27.8	22.8	18.8	13.0	5.0	6.3	16.4	20.9	24.9	29.7	33.9	37.1	40.3	
	Quota (m)	166.1																										
S6	Progressiva (m)	67.39	PS6	75.2	73.6	71.2	67.8	65.2	61.7	58.5	55.9	53.0	50.3	47.1	44.0	40.3	35.7	31.5	28.6	24.9	20.9	14.6	5.3	5.0	13.8	18.5	22.5	
	Quota (m)	165.1																										
S7	Progressiva (m)	77.33	PS7	87.1	84.5	82.4	80.0	77.6	74.7	71.2	68.3	64.9	61.7	58.5	54.6	51.4	48.7	44.8	41.6	38.9	34.4	30.7	25.7	21.7	17.5	13.0	4.5	
	Quota (m)	164.0																										

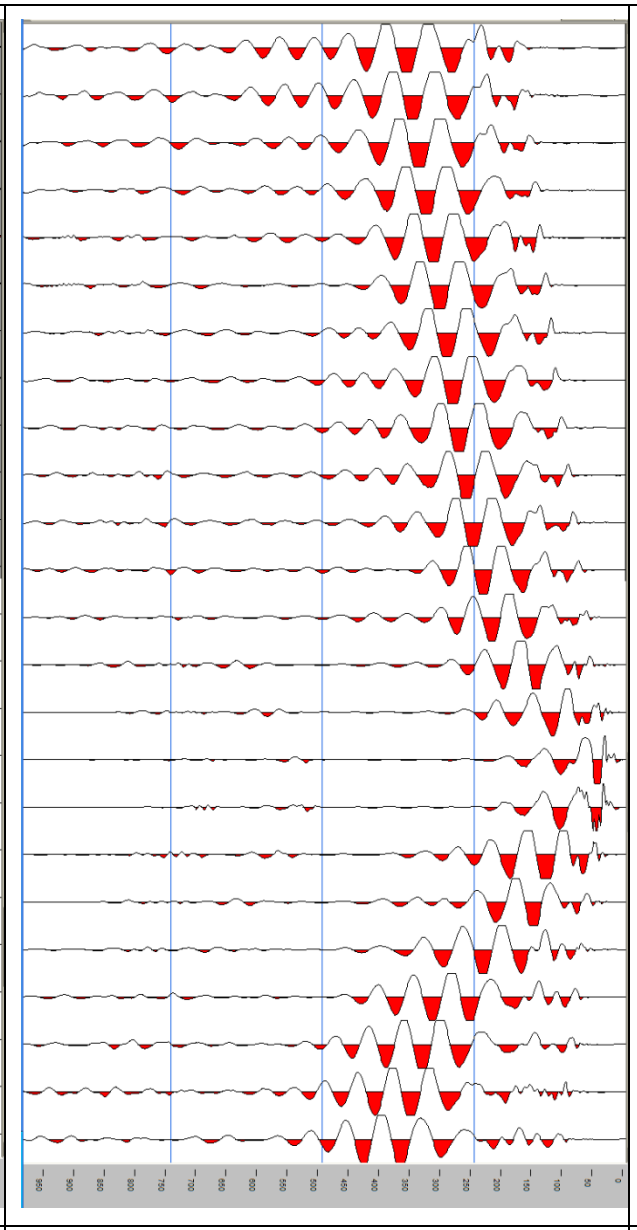


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

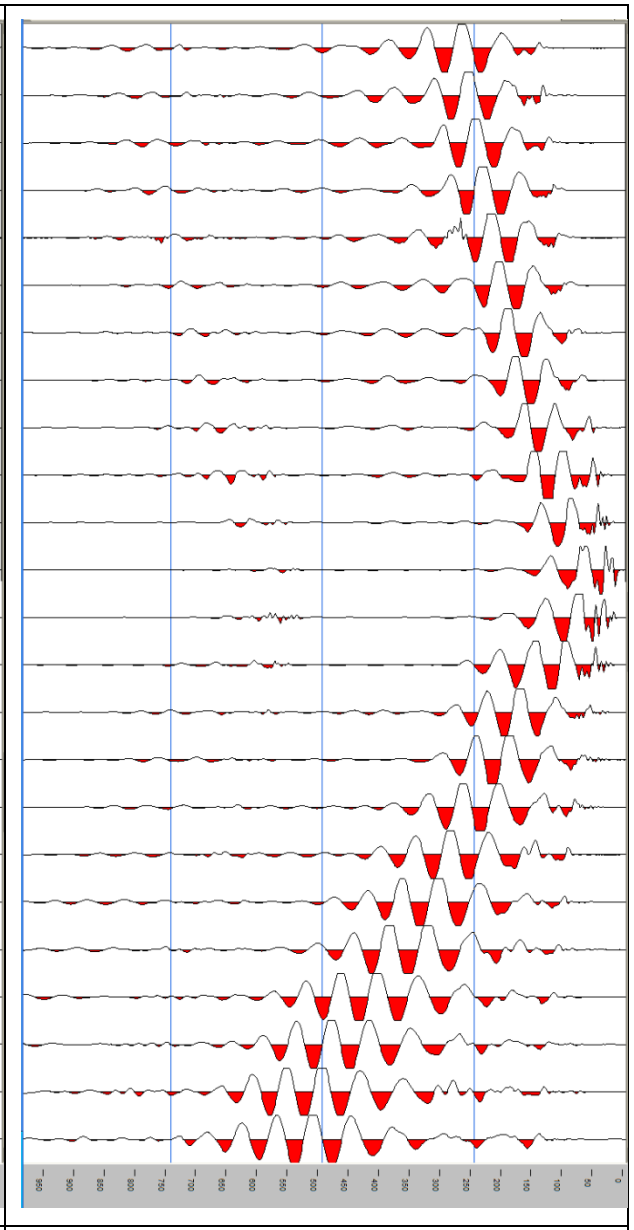




SP6



SP5



SP4

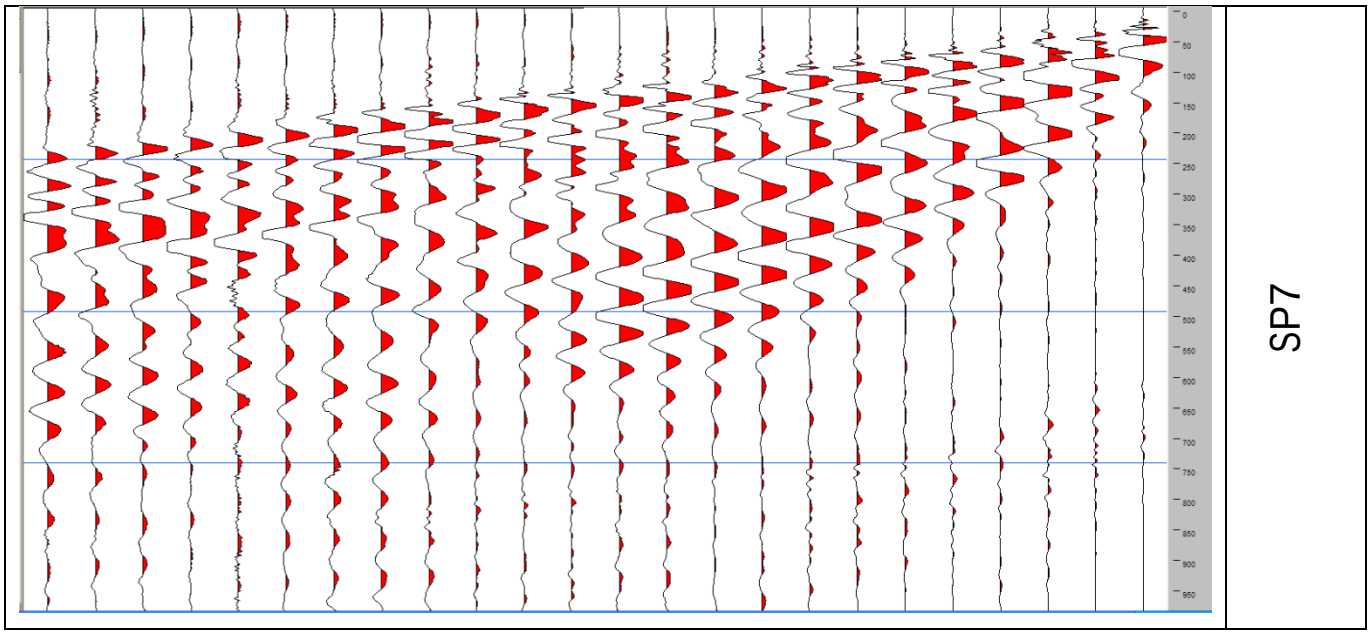
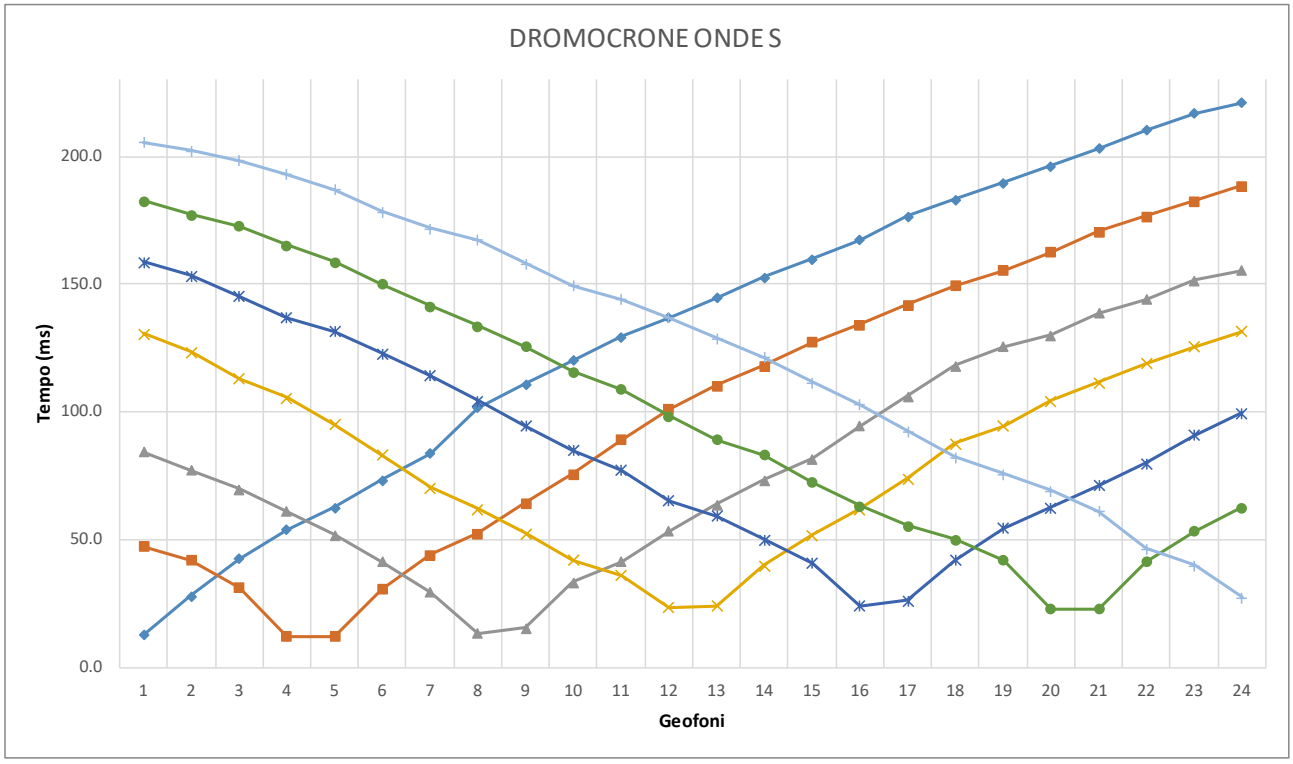


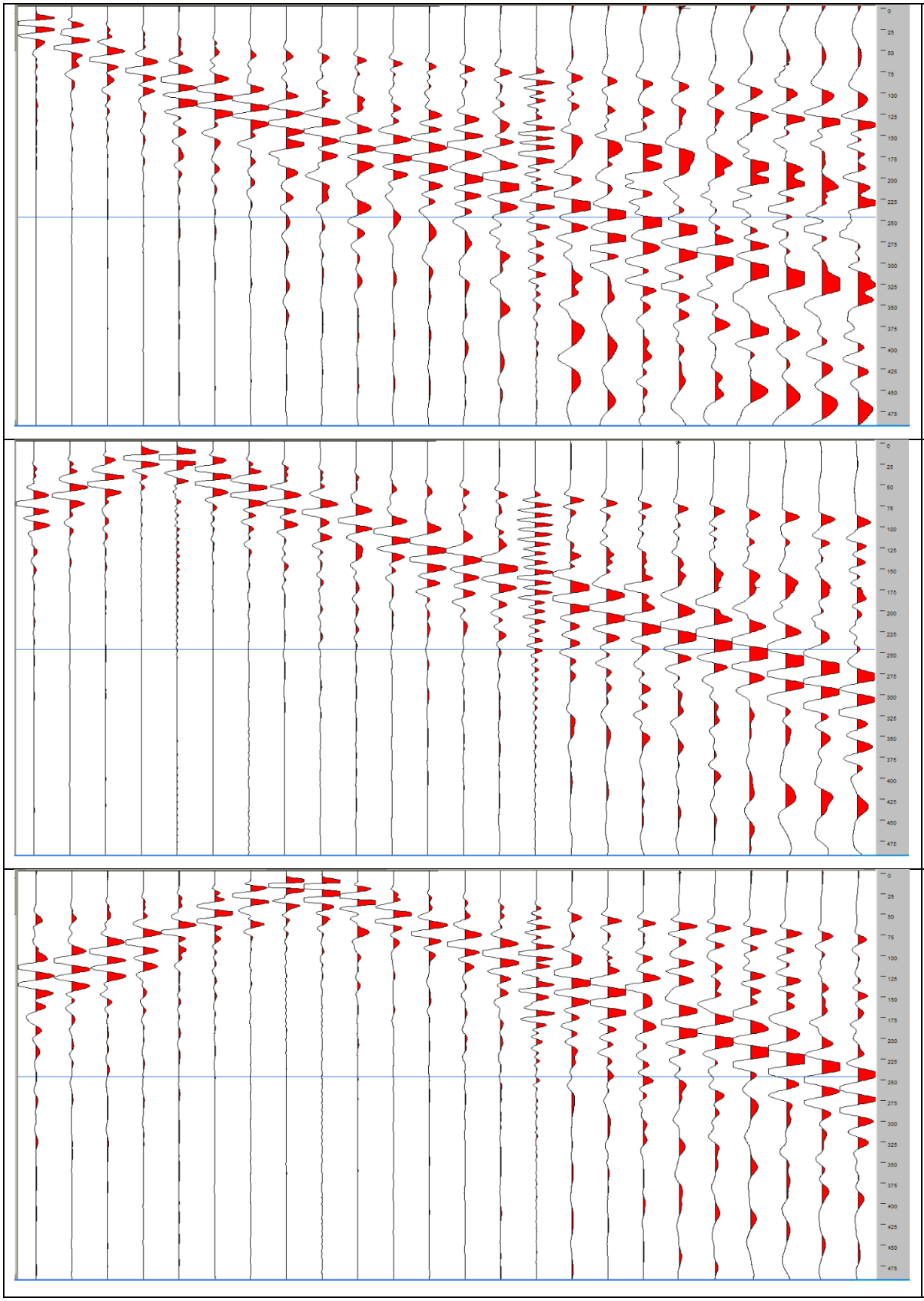
Tabella geometria e tempi onde S

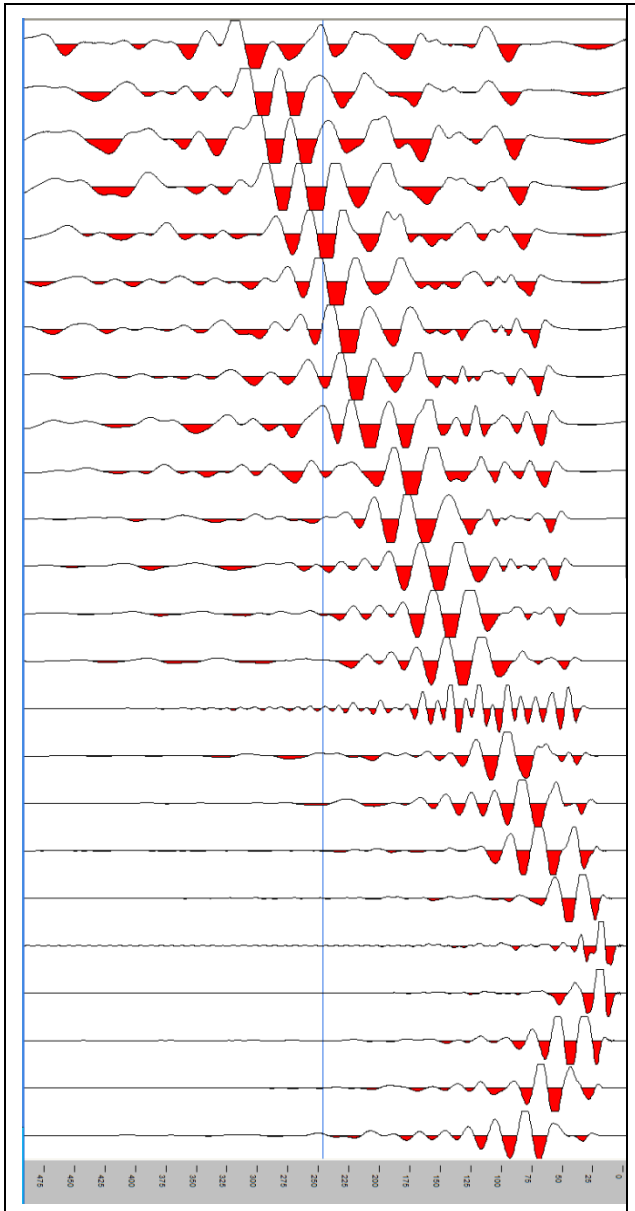
ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				18.88	21.37	23.86	26.36	28.85	31.34	33.83	36.32	38.8	41.29	43.77	46.26	48.74	51.23	53.72	56.2	58.69	61.17	63.66	66.14	68.63	71.12	73.6	76.09	Progressiva (m)
				169.9	169.7	169.5	169.3	169.1	168.9	168.7	168.4	168.1	167.9	167.6	167.3	167.1	166.8	166.5	166.3	166.0	165.7	165.5	165.2	164.9	164.7	164.4	164.1	Quota (m)
S1	Progressiva (m)	17.63	PS1	12.8	28.1	42.7	53.9	62.6	73.2	83.8	101.7	110.9	120.2	129.5	136.8	144.7	152.7	160.0	167.3	176.6	183.2	189.8	196.4	203.1	210.4	217.0	221.0	Tempo (ms)
	Quota (m)	170.0																										
S2	Progressiva (m)	27.6	PS2	47.3	42.0	31.4	12.2	12.2	30.7	44.0	52.6	64.5	75.8	89.1	101.0	110.3	118.2	127.5	134.1	142.1	149.4	155.3	162.6	170.6	176.6	182.5	188.5	
	Quota (m)	169.2																										
S3	Progressiva (m)	37.56	PS3	84.4	77.1	69.8	61.2	51.9	41.3	29.4	13.5	15.5	33.4	41.3	53.3	63.9	73.2	81.8	94.4	106.3	118.2	125.5	130.2	138.8	144.1	151.4	155.3	
	Quota (m)	168.3																										
S4	Progressiva (m)	47.5	PS4	130.8	123.5	112.9	105.6	95.0	83.1	70.5	61.9	52.6	42.0	36.0	23.4	24.1	40.0	51.9	61.9	73.8	87.7	94.4	104.3	111.6	118.9	125.5	131.5	
	Quota (m)	167.2																										
S5	Progressiva (m)	57.44	PS5	158.7	153.4	145.4	136.8	131.5	122.9	114.3	104.3	94.4	85.1	77.1	65.2	59.2	50.0	40.7	24.1	26.1	42.0	54.6	62.6	71.2	79.8	91.1	99.7	
	Quota (m)	166.1																										
S6	Progressiva (m)	67.39	PS6	182.5	177.2	172.6	165.3	158.7	150.0	141.4	133.5	125.5	115.6	108.9	98.3	89.1	83.1	72.5	63.2	55.3	50.0	42.0	22.8	22.8	41.3	53.3	62.6	
	Quota (m)	165.1																										
S7	Progressiva (m)	77.33	PS7	205.7	202.4	198.4	193.1	187.2	178.5	171.9	167.3	158.0	149.4	144.1	136.8	128.8	121.5	111.6	103.0	92.4	82.4	75.8	69.2	61.2	46.6	40.0	27.4	
	Quota (m)	164.0																										



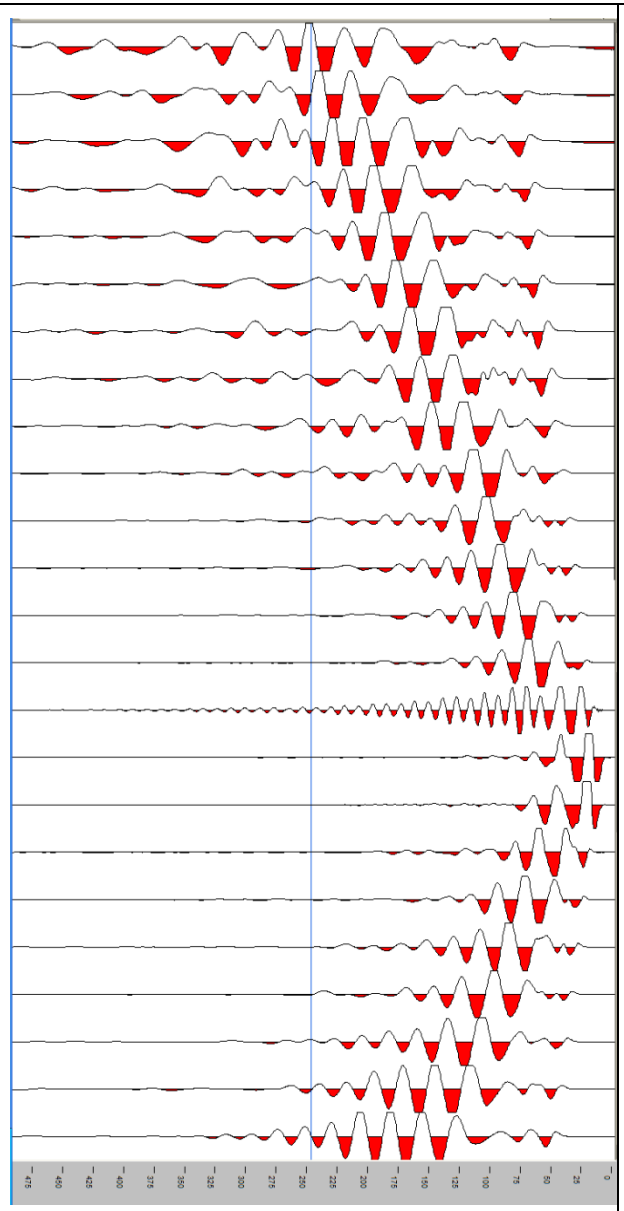
PROFILO SISMICO P

Sismogrammi onde P

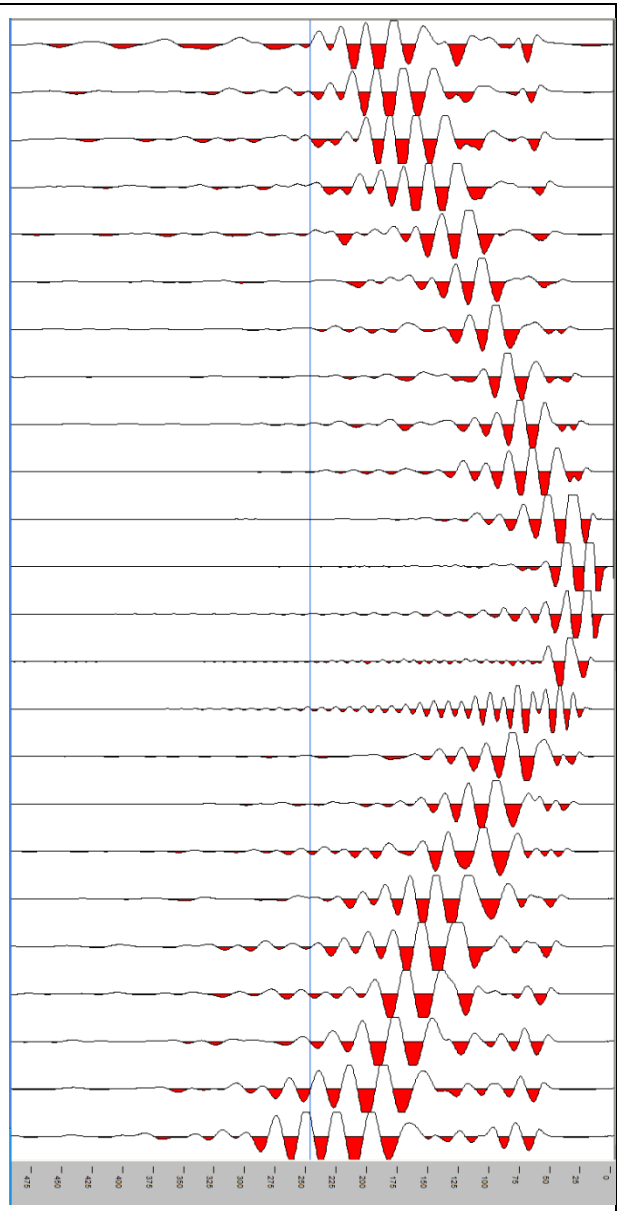




SP6



SP5



SP4

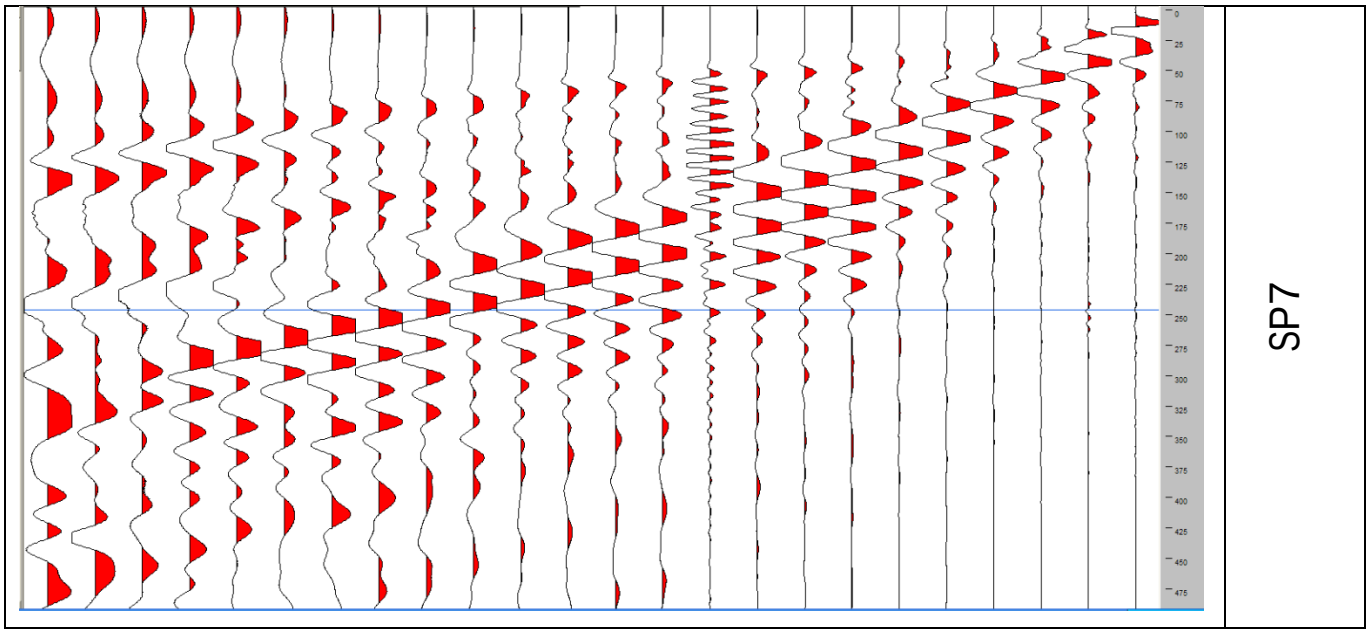
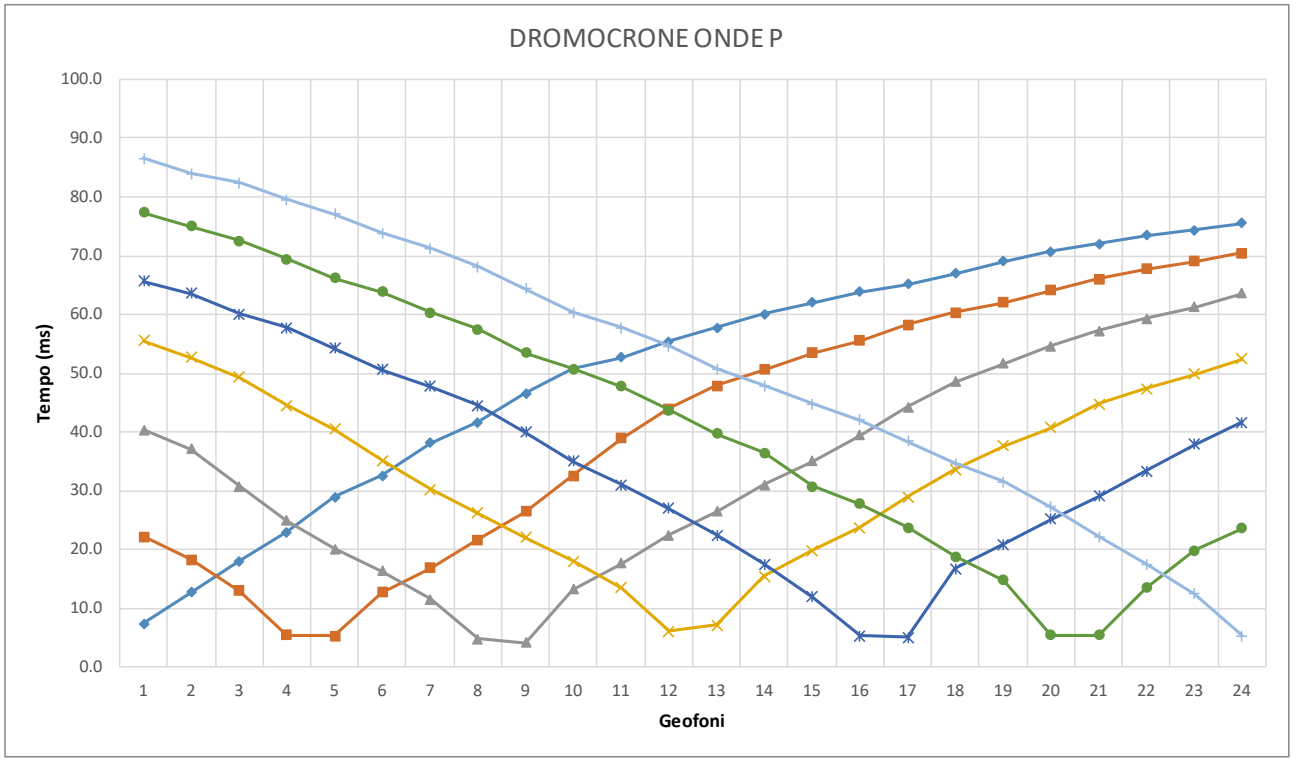
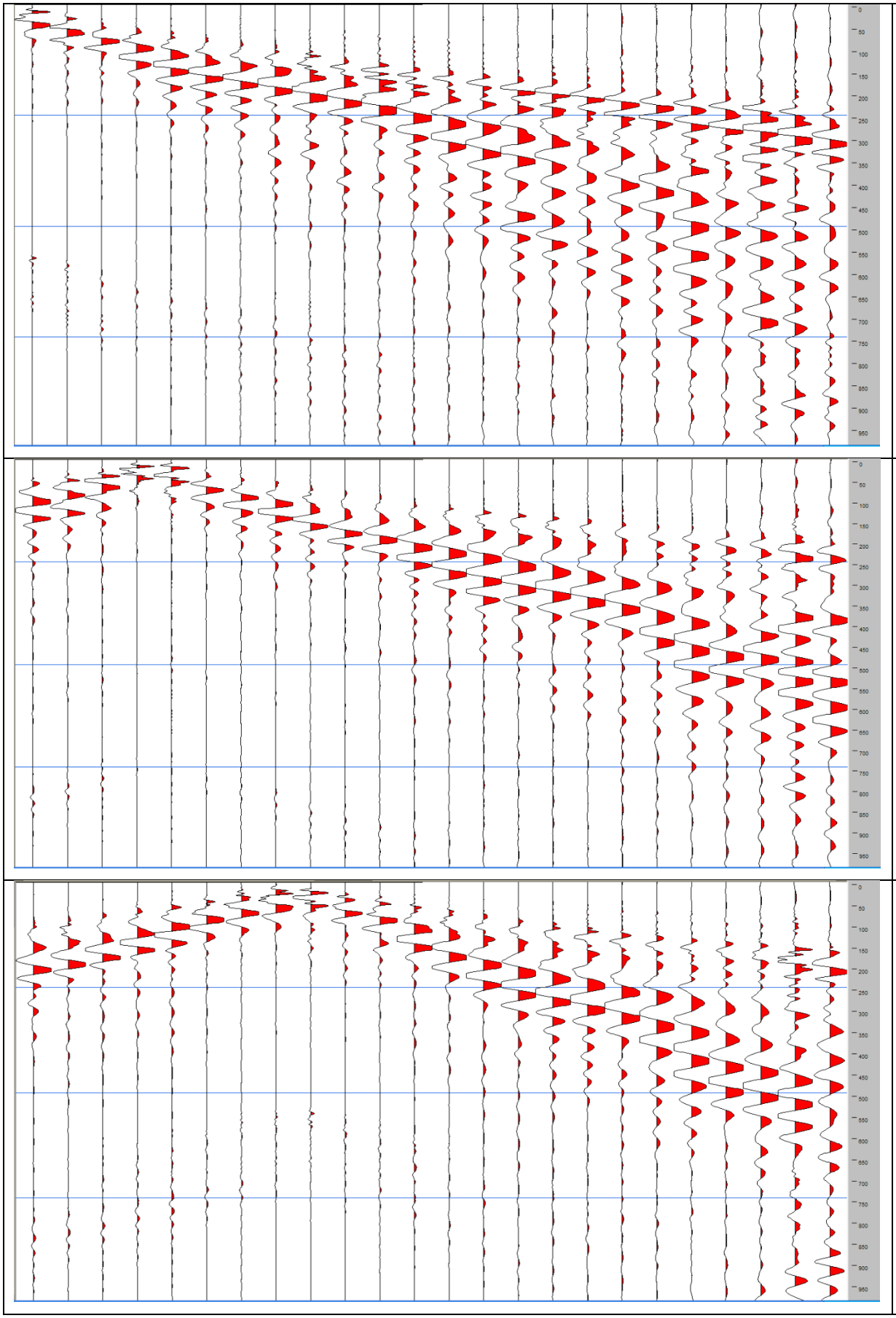


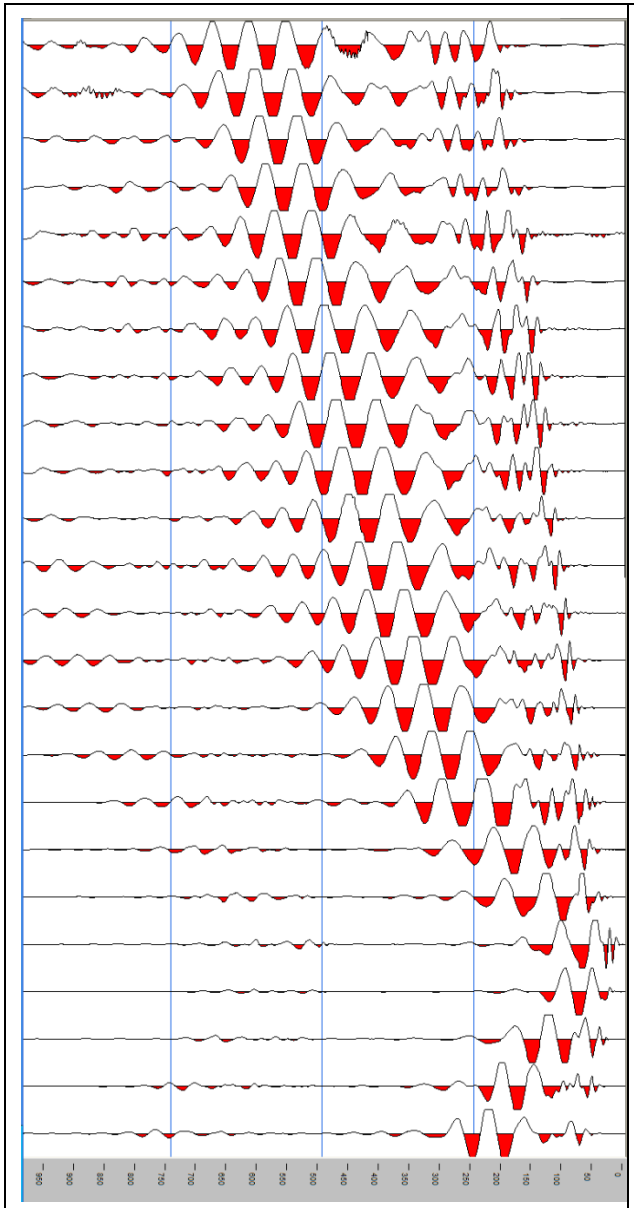
Tabella geometria e tempi onde P

	ONDE P			GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	7.4	12.7	18.0	23.0	28.9	32.6	38.1	41.6	46.6	50.8	52.7	55.4	57.7	60.1	62.0	63.8	65.2	67.0	69.1	70.7	72.0	73.4	74.4	75.5	Tempo (ms)
	Quota (m)	210.0																										
S2	Progressiva (m)	11.25	PS2	22.2	18.3	13.0	5.5	5.3	12.7	16.9	21.7	26.5	32.6	38.9	44.0	47.9	50.6	53.5	55.6	58.3	60.4	62.0	64.1	66.0	67.8	69.1	70.5	
	Quota (m)	210.0																										
S3	Progressiva (m)	21.25	PS3	40.3	37.1	30.7	24.9	20.1	16.4	11.6	4.8	4.2	13.2	17.7	22.5	26.5	31.0	35.0	39.5	44.2	48.5	51.6	54.6	57.2	59.3	61.2	63.6	
	Quota (m)	210.0																										
S4	Progressiva (m)	31.25	PS4	55.6	52.7	49.3	44.5	40.5	35.2	30.2	26.2	22.0	18.0	13.5	6.1	7.1	15.4	19.9	23.8	28.9	33.6	37.6	40.8	44.8	47.4	49.8	52.4	
	Quota (m)	210.0																										
S5	Progressiva (m)	41.25	PS5	65.7	63.6	60.1	57.7	54.3	50.6	47.7	44.5	40.0	35.0	31.0	27.0	22.5	17.5	11.9	5.3	5.0	16.7	20.9	25.2	29.1	33.4	37.9	41.6	
	Quota (m)	210.0																										
S6	Progressiva (m)	51.25	PS6	77.3	75.0	72.6	69.4	66.2	63.8	60.4	57.5	53.5	50.8	47.7	43.7	39.7	36.5	30.7	27.8	23.8	18.8	14.8	5.5	5.5	13.5	19.9	23.6	
	Quota (m)	210.0																										
S7	Progressiva (m)	61.25	PS7	86.6	84.0	82.4	79.5	77.1	73.9	71.2	68.1	64.4	60.4	57.7	54.6	50.8	47.9	44.8	42.1	38.4	34.7	31.5	27.3	22.2	17.5	12.4	5.3	
	Quota (m)	210.0																										

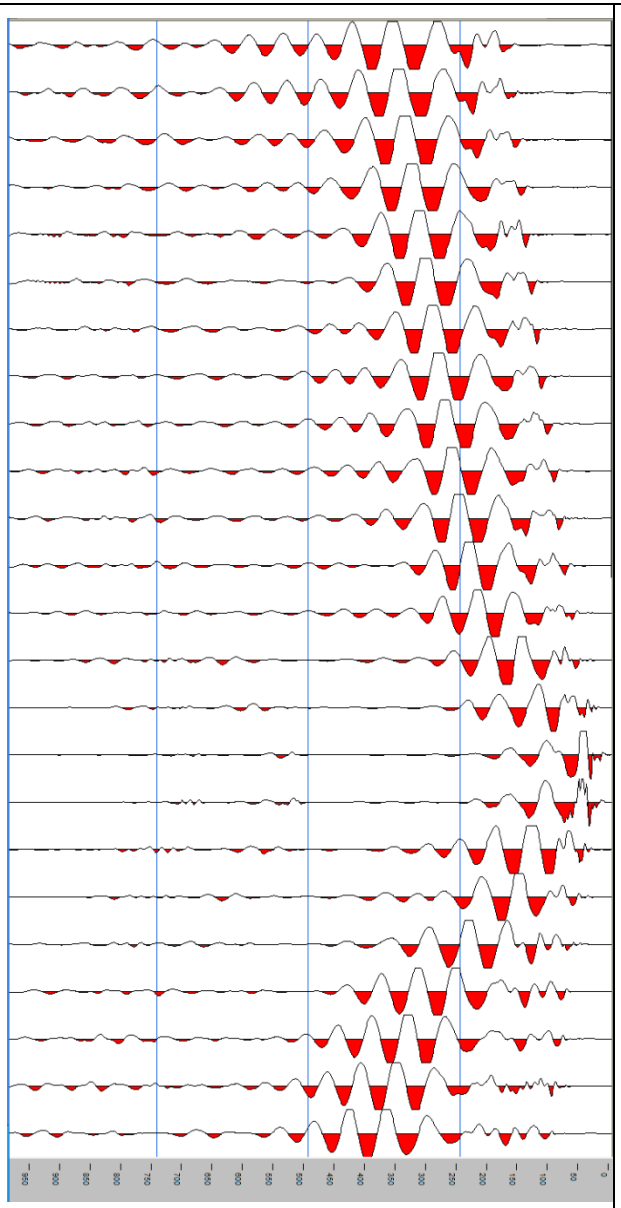


Sismogrammi onde S (somma delle due energizzazioni con inversione di fase)

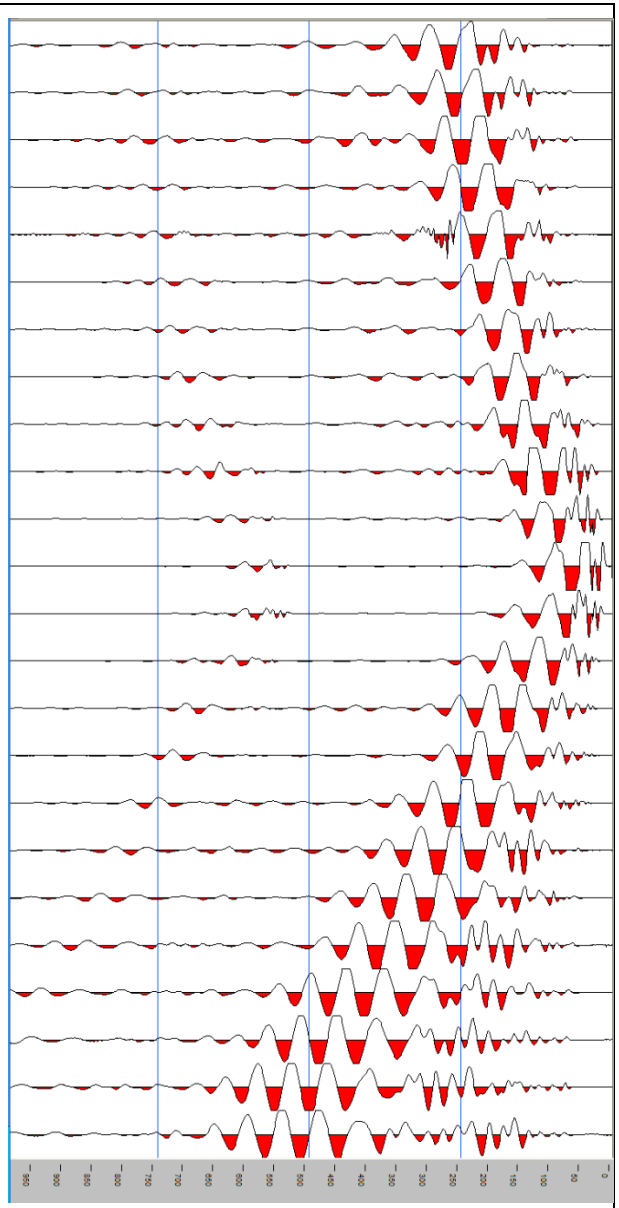




SP6



SP5



SP4

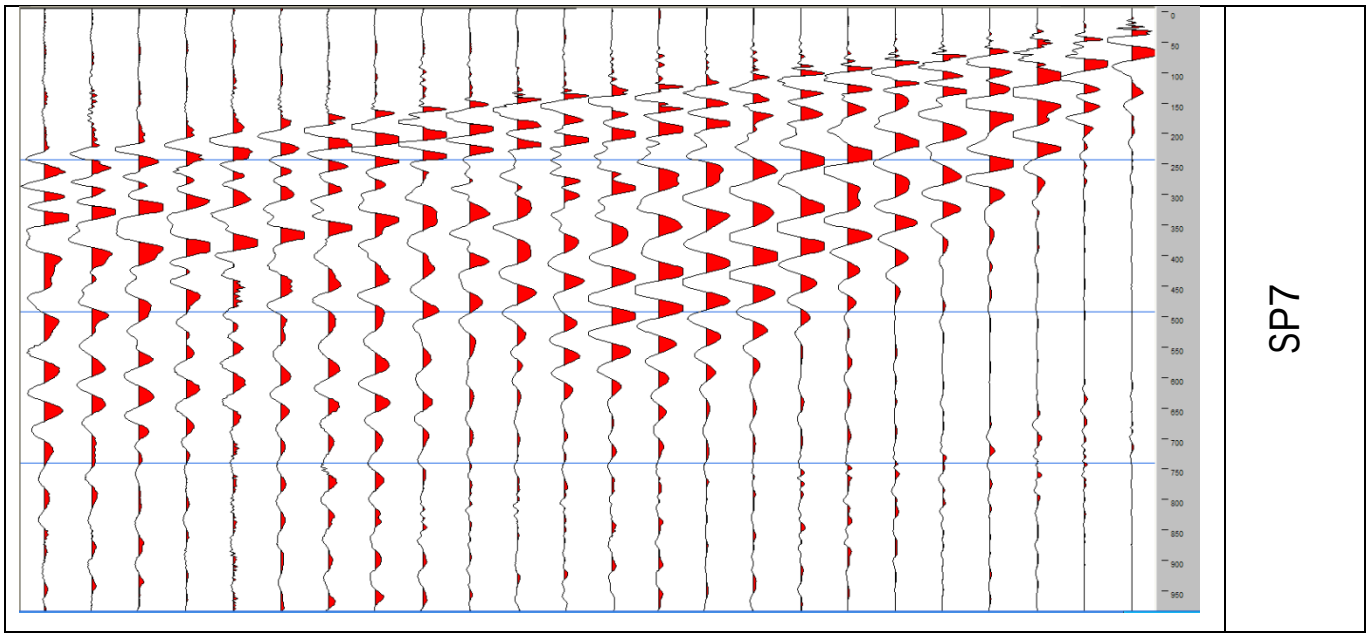
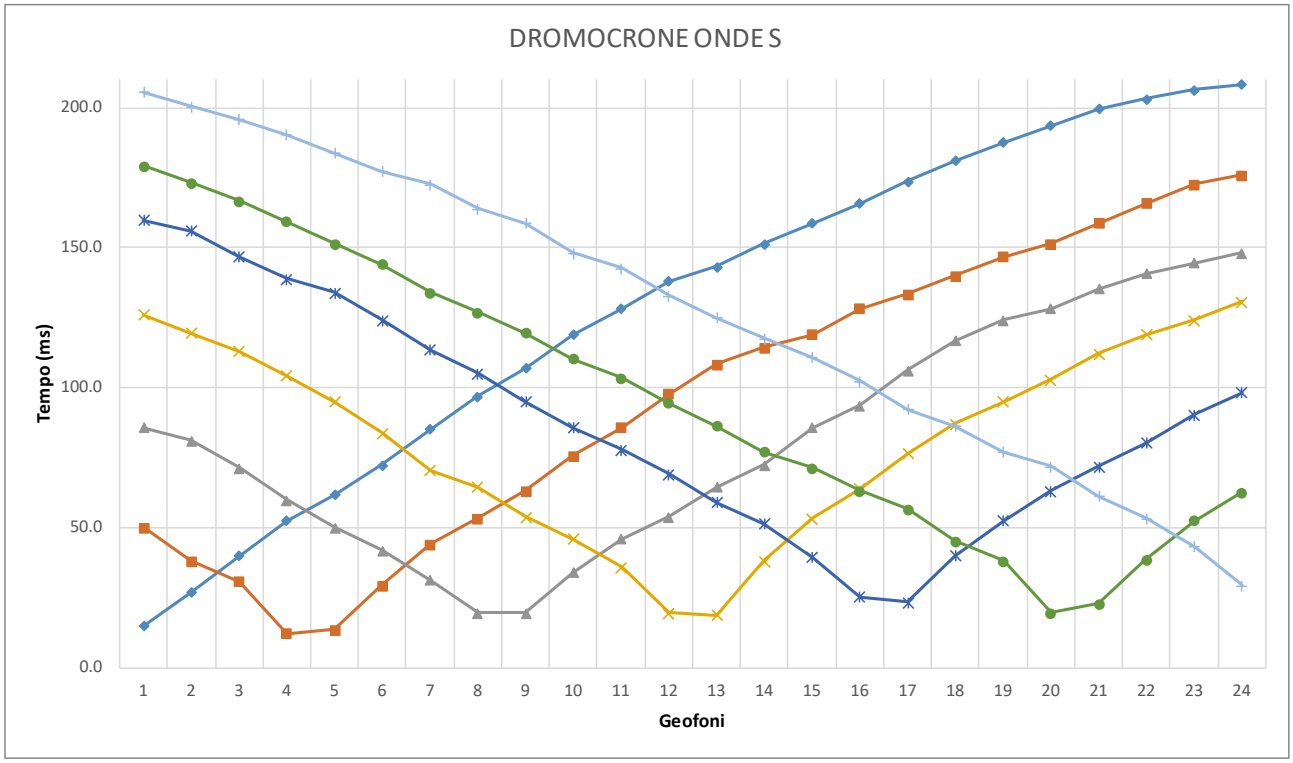


Tabella geometria e tempi onde S

ONDE S				GEOFONI 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60	Progressiva (m)
				210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0	Quota (m)
S1	Progressiva (m)	1.25	PS1	14.8	26.8	40.0	52.6	61.9	72.5	85.1	97.0	107.0	118.9	128.2	138.1	143.4	151.4	158.7	165.9	173.9	181.2	187.8	193.8	199.8	203.1	206.4	208.4	Tempo (ms)
	Quota (m)	210.0																										
S2	Progressiva (m)	11.25	PS2	50.0	38.0	30.7	12.2	13.5	29.4	44.0	53.3	63.2	75.8	85.8	97.7	108.3	114.3	118.9	128.2	133.5	140.1	146.7	151.4	158.7	165.9	172.6	175.9	
	Quota (m)	210.0																										
S3	Progressiva (m)	21.25	PS3	85.8	81.1	71.2	59.9	50.0	42.0	31.4	19.5	19.5	34.1	46.0	53.9	64.5	72.5	85.8	93.7	106.3	116.9	124.2	128.2	135.5	140.8	144.7	148.1	
	Quota (m)	210.0																										
S4	Progressiva (m)	31.25	PS4	126.2	119.6	112.9	104.3	95.0	83.8	70.5	64.5	53.9	46.0	36.0	19.5	18.8	38.0	53.3	63.9	76.5	87.1	95.0	103.0	112.3	118.9	124.2	130.8	
	Quota (m)	210.0																										
S5	Progressiva (m)	41.25	PS5	160.0	156.0	146.7	138.8	134.1	124.2	113.6	105.0	95.0	85.8	77.8	69.2	59.2	51.3	39.4	25.4	23.4	40.0	52.6	63.2	71.8	80.4	90.4	98.3	
	Quota (m)	210.0																										
S6	Progressiva (m)	51.25	PS6	179.2	173.2	166.6	159.3	151.4	144.1	134.1	126.8	119.6	110.3	103.6	94.4	86.4	77.1	71.2	63.2	56.6	45.3	38.0	19.5	22.8	38.7	52.6	62.6	
	Quota (m)	210.0																										
S7	Progressiva (m)	61.25	PS7	205.7	200.4	195.8	190.5	183.8	177.2	172.6	164.0	158.7	148.1	142.8	132.8	124.9	117.6	110.9	102.3	92.4	86.4	77.1	71.8	61.2	53.3	43.3	29.4	
	Quota (m)	210.0																										



ESAC 1

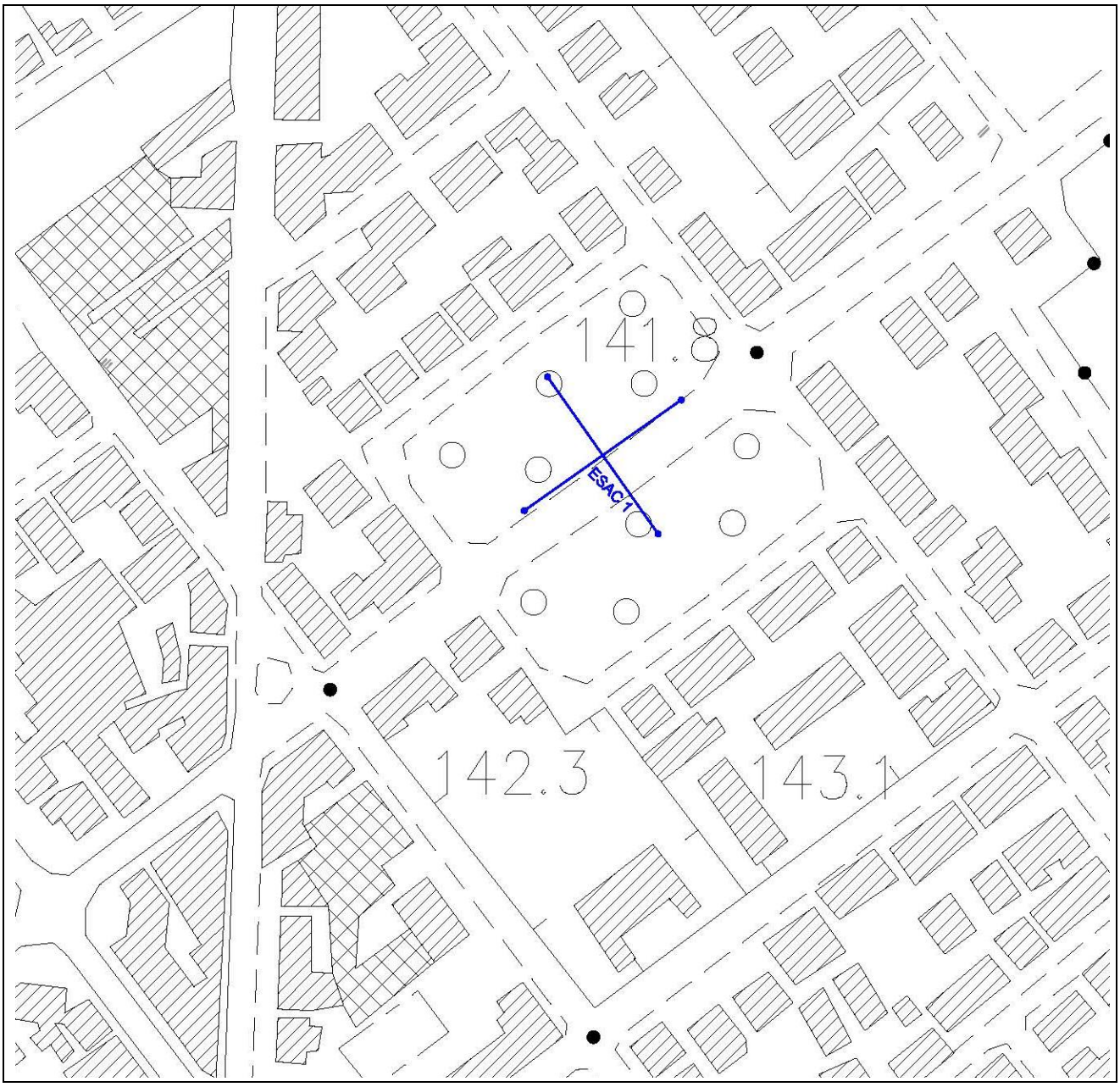


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

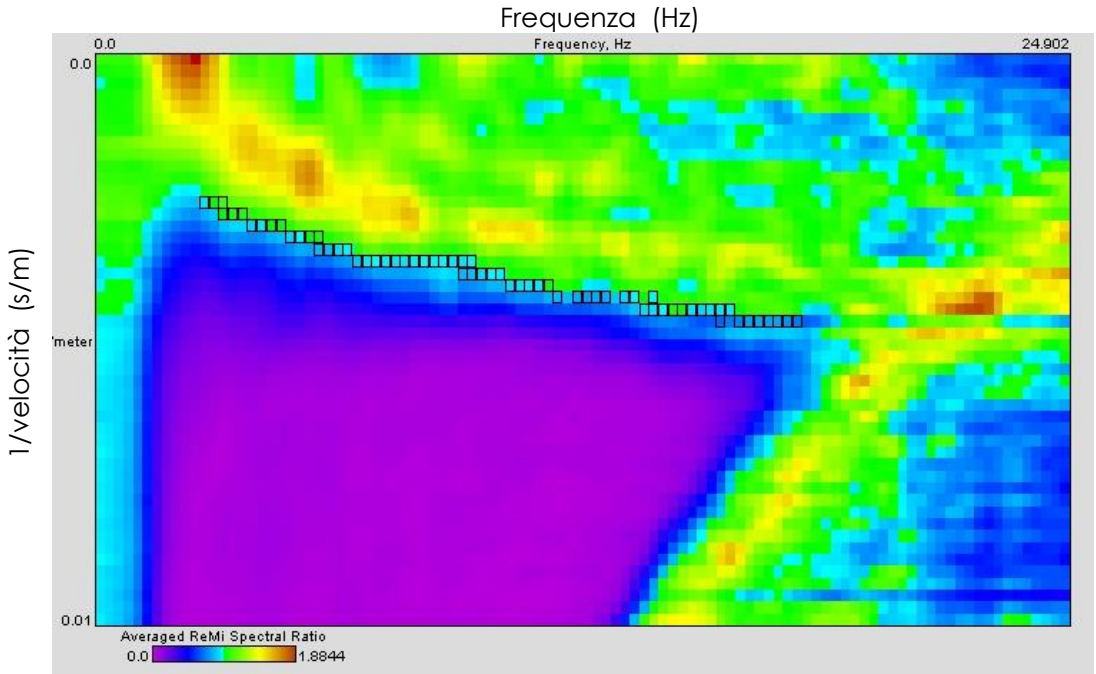


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

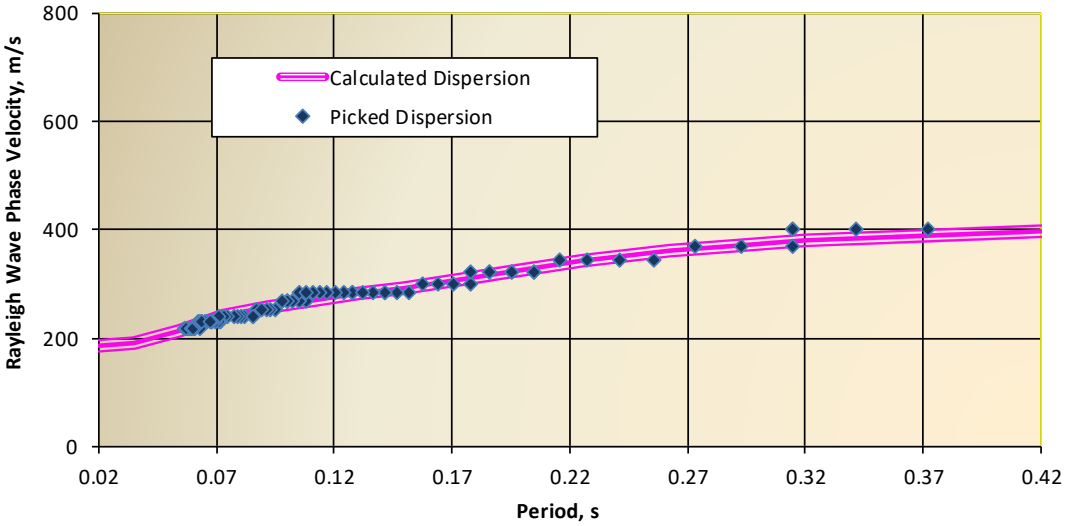


Figura: Diagramma periodo – velocità di fase

Montevarchi 1

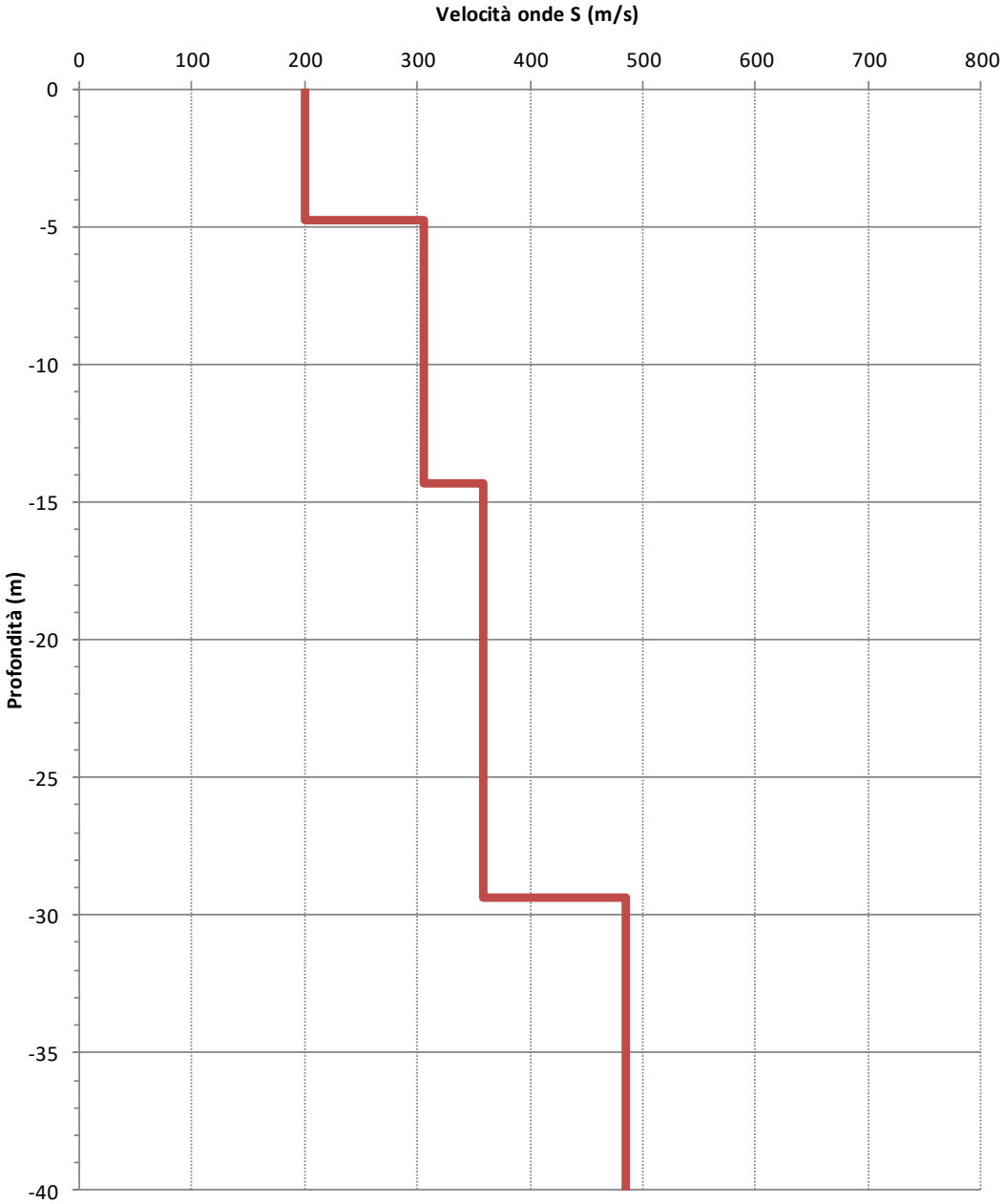


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	4,8	200
4,8	14,3	306
14,3	29,4	359
29,4	40,0	485

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **307 m/s**.

ESAC 2

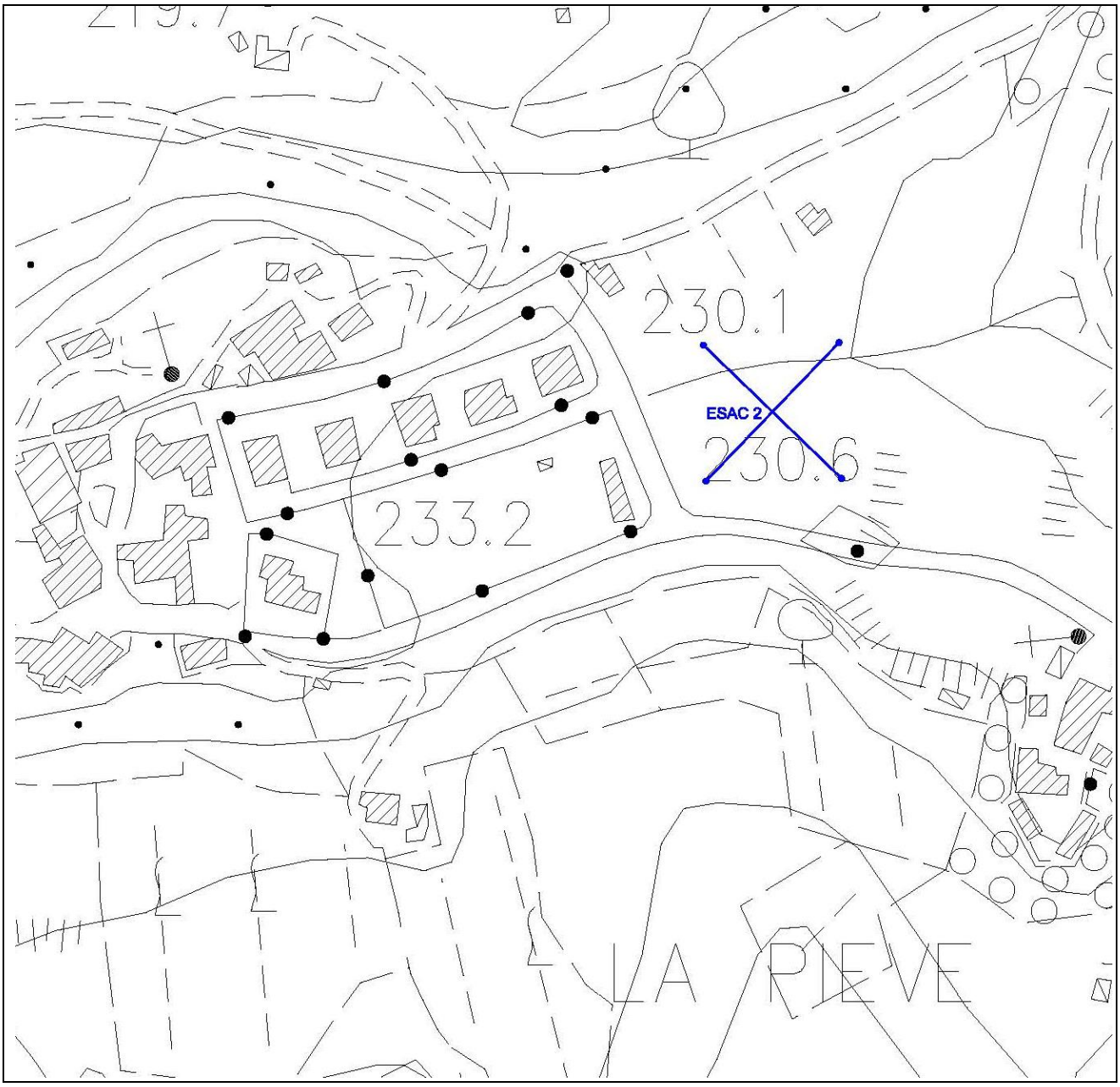


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

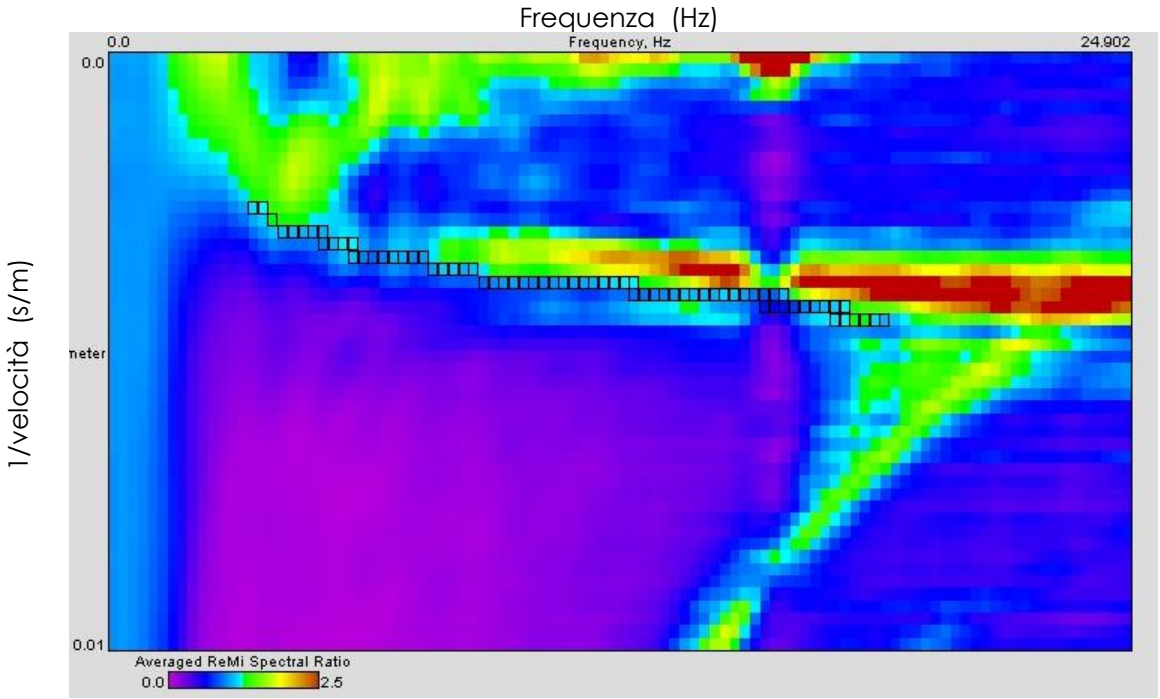


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

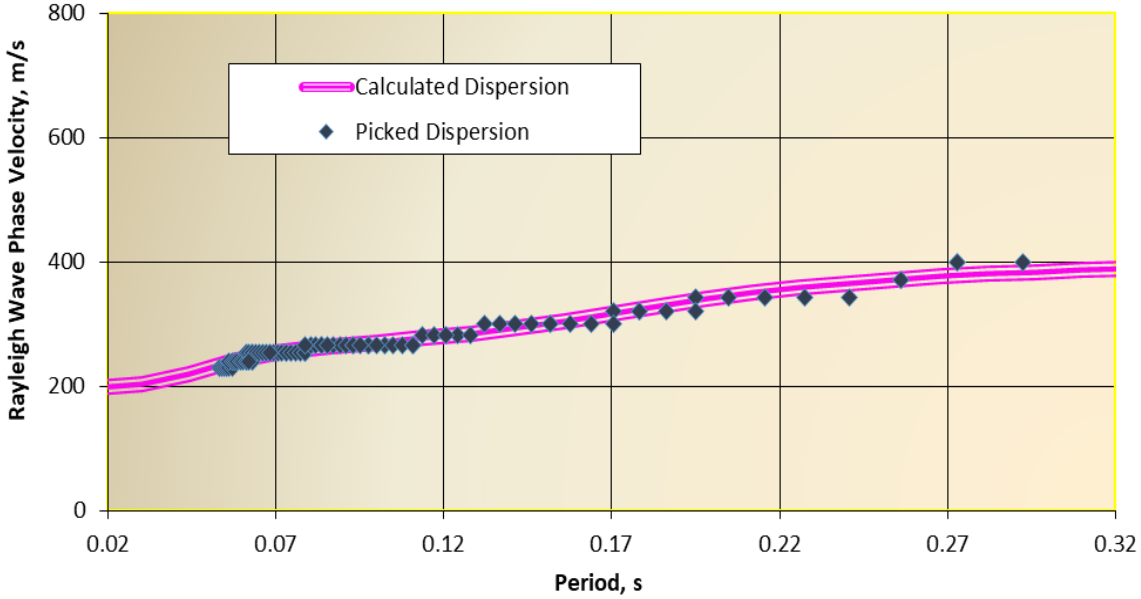


Figura: Diagramma periodo – velocità di fase

Montevarchi 2

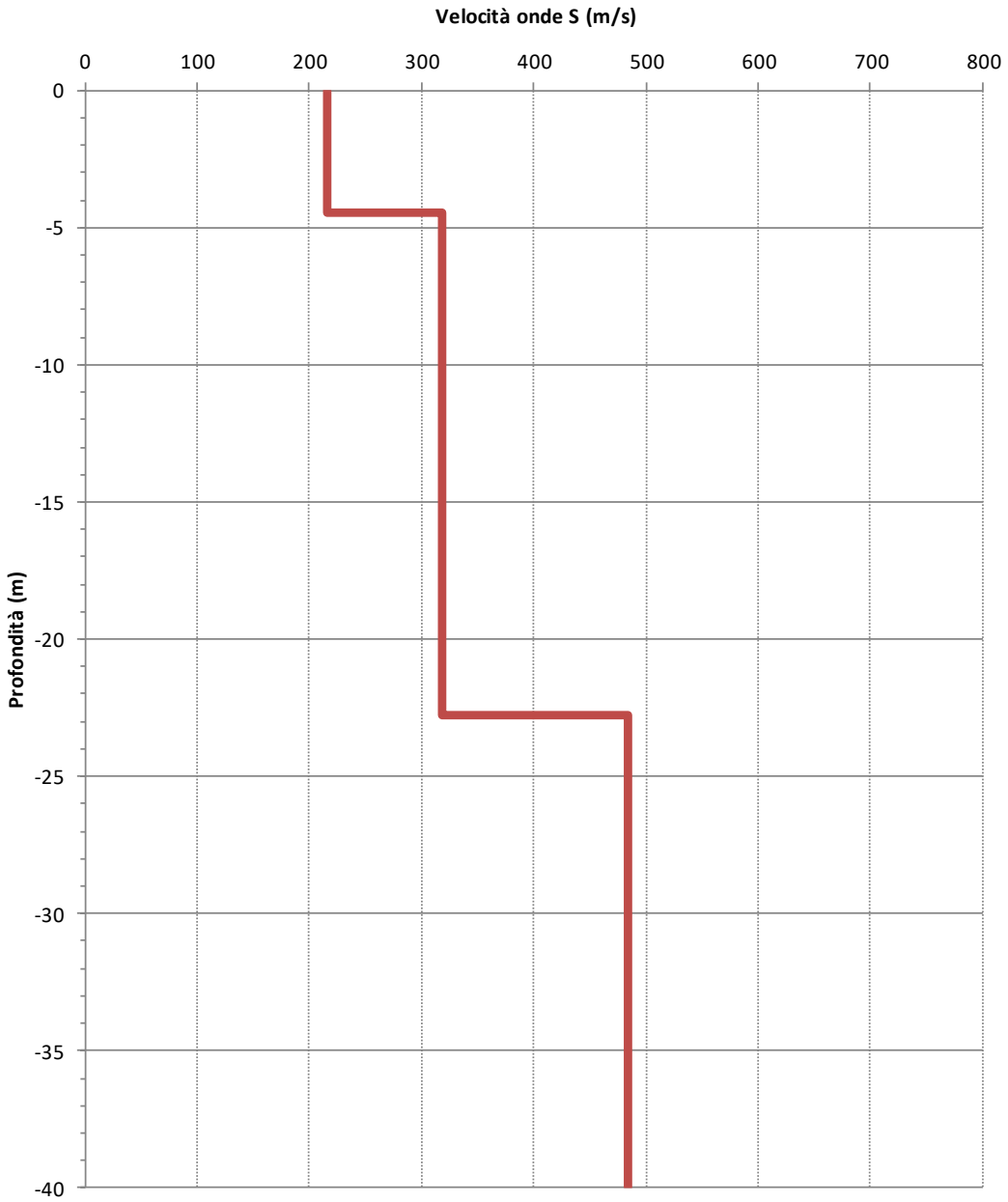


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	4,5	215
4,5	22,8	318
22,8	40	484

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **323 m/s**.

ESAC 3

Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

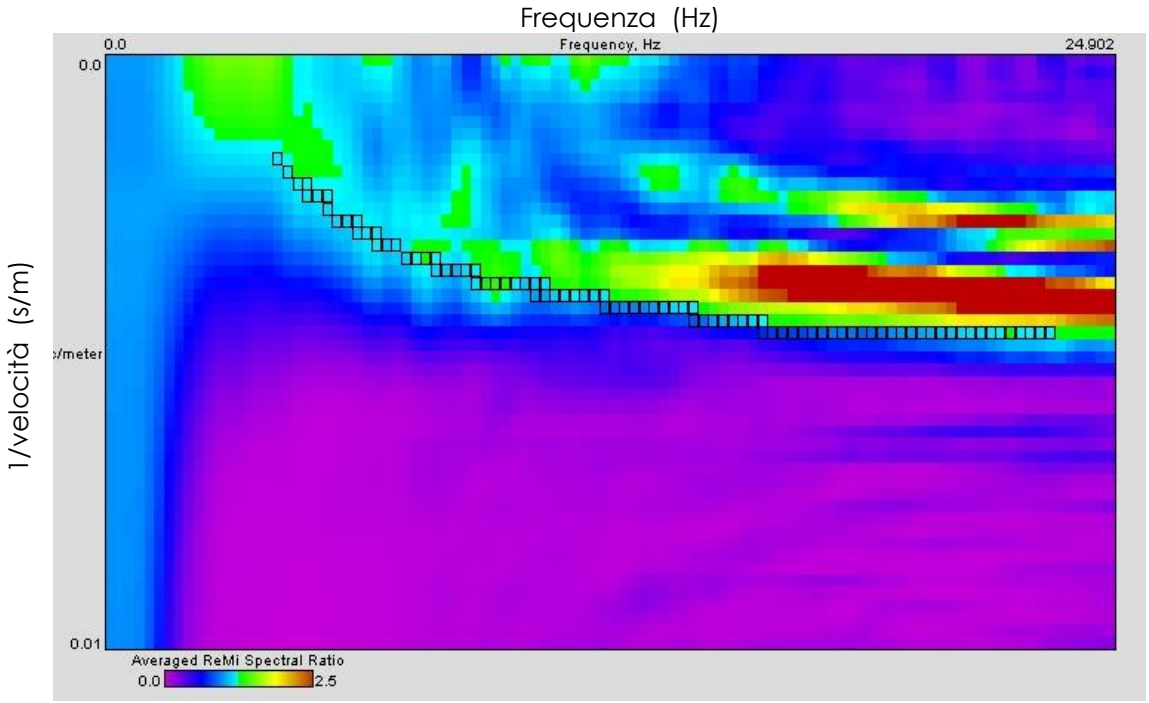


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

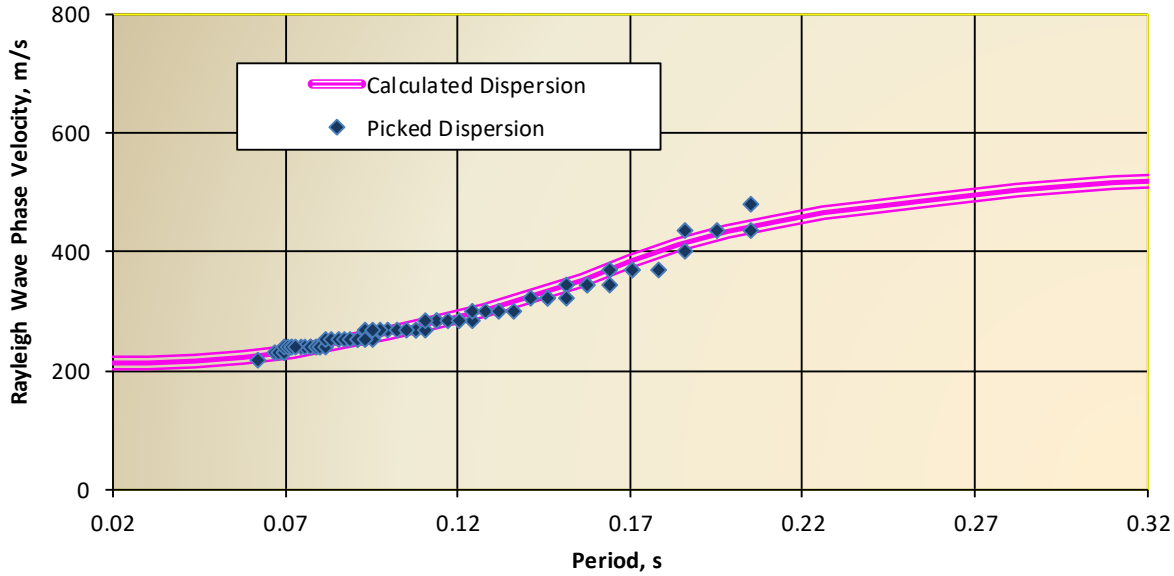


Figura: Diagramma periodo – velocità di fase

Montevarchi 3

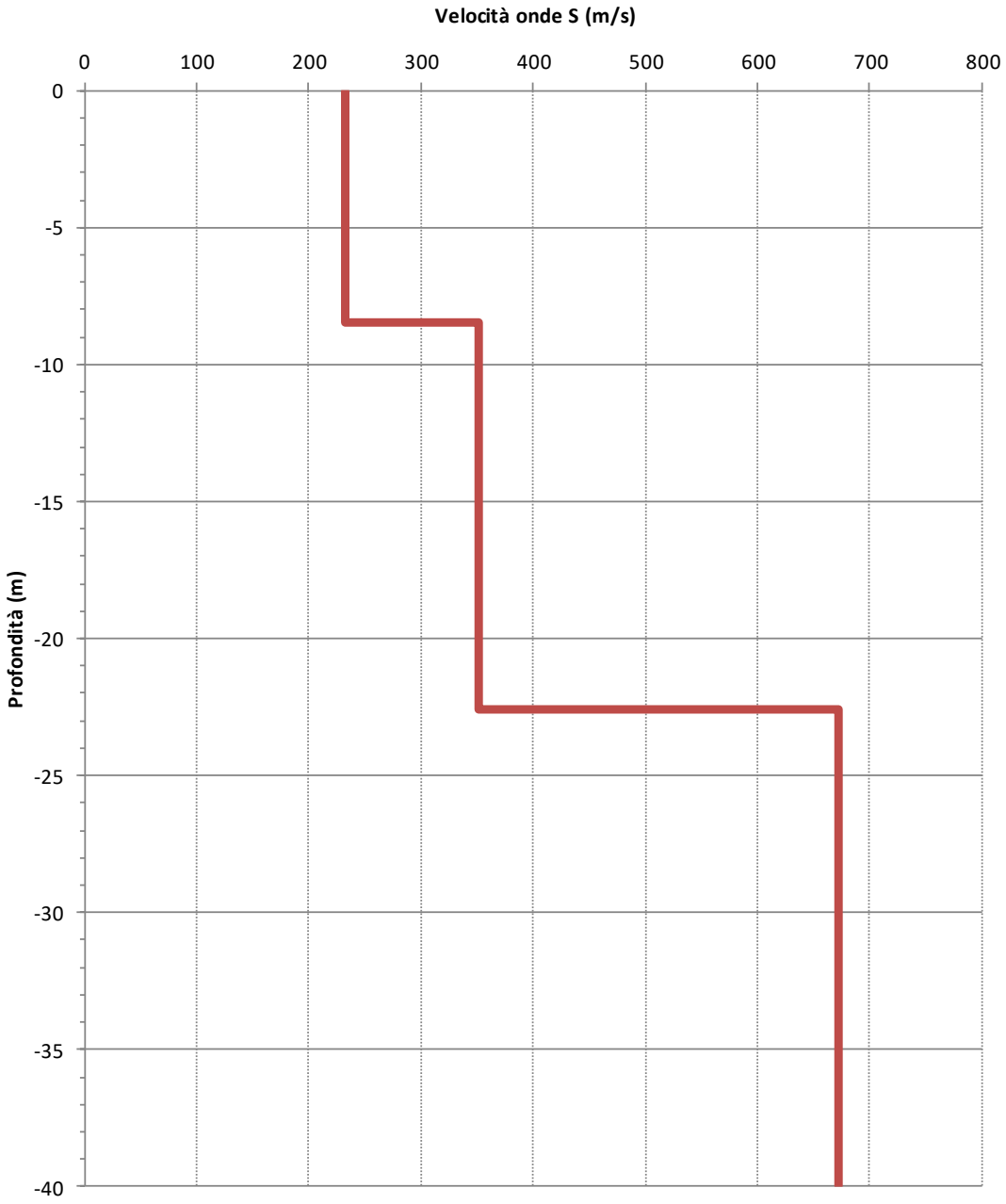


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	8,5	234
8,5	22,6	351
22,6	40	672

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **345 m/s**.

ESAC 4

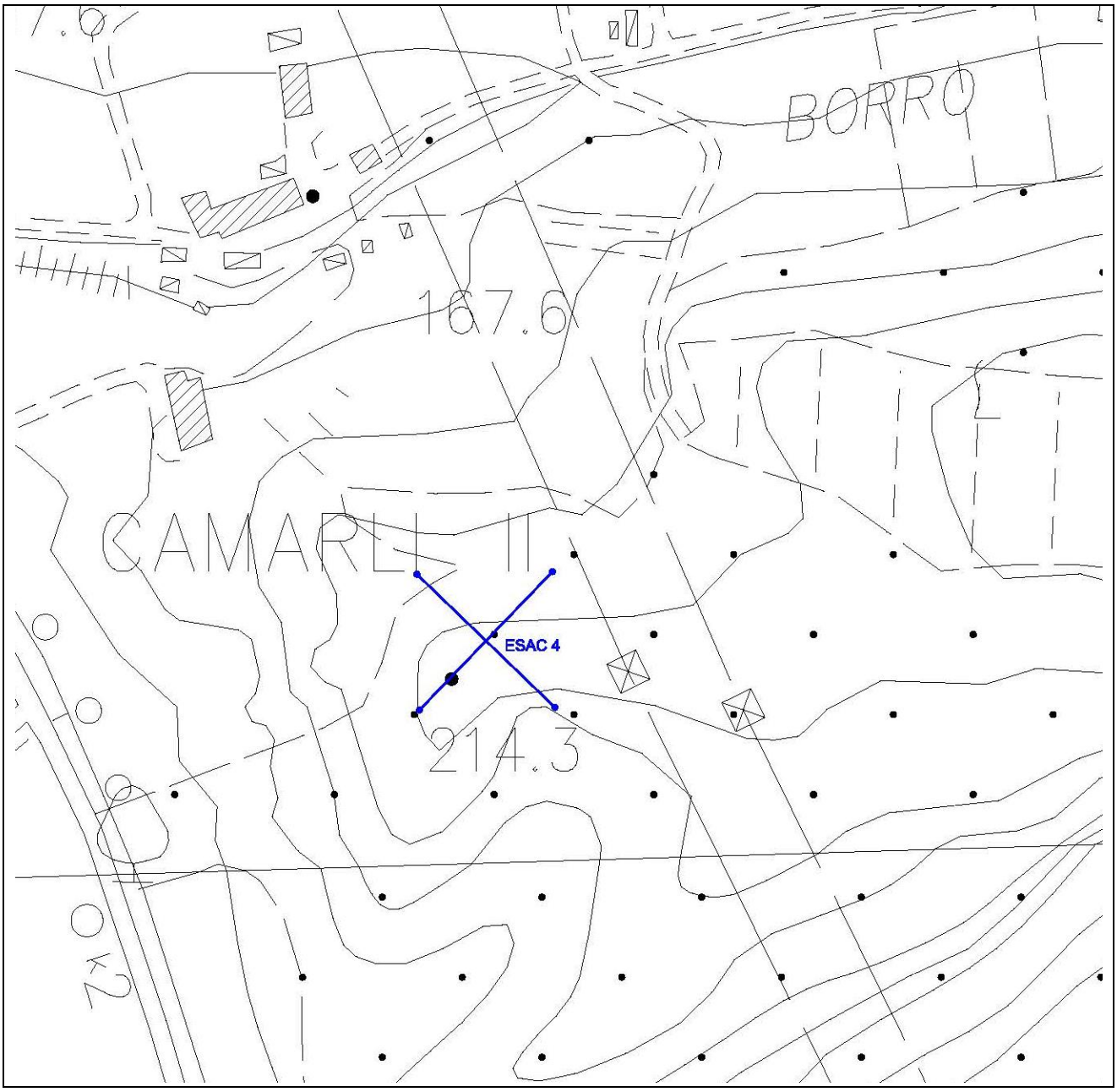


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

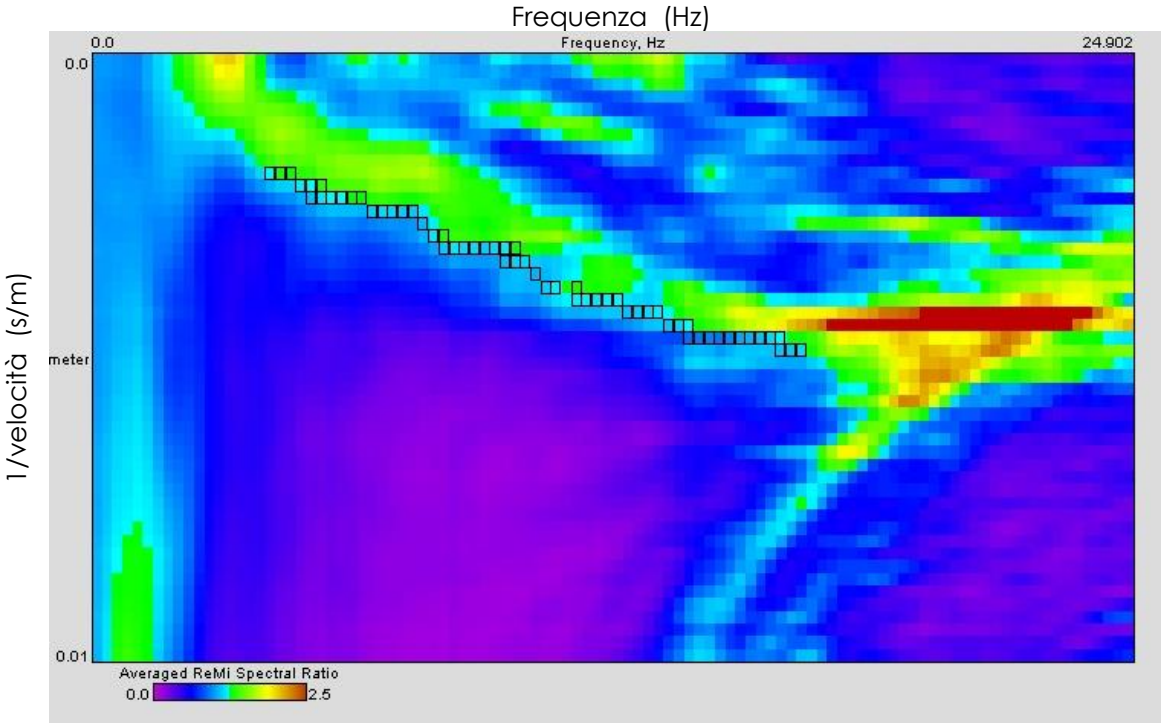


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

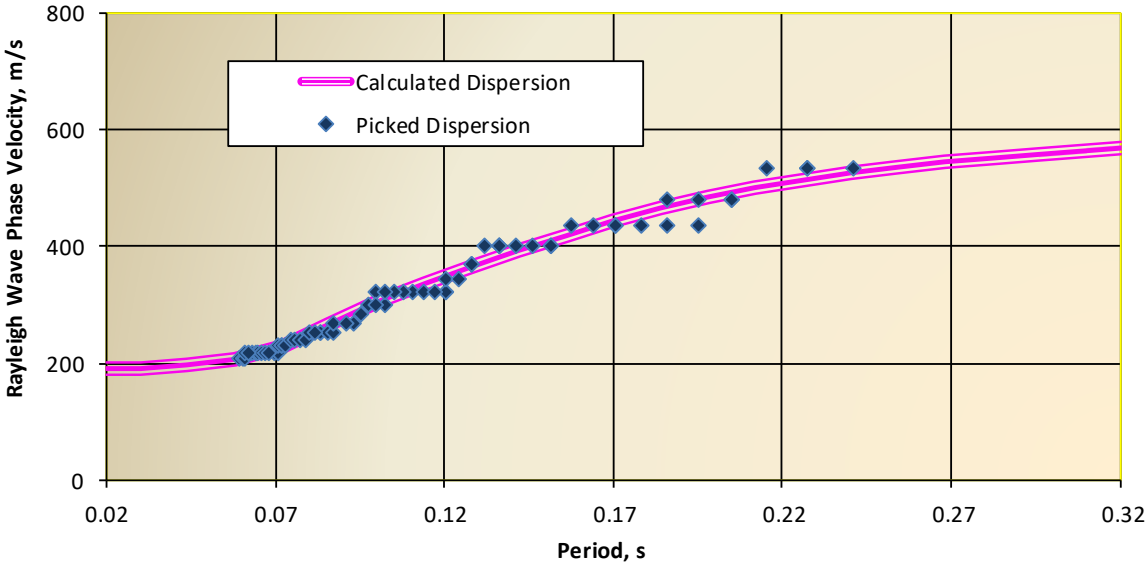


Figura: Diagramma periodo – velocità di fase

Montevarchi 4

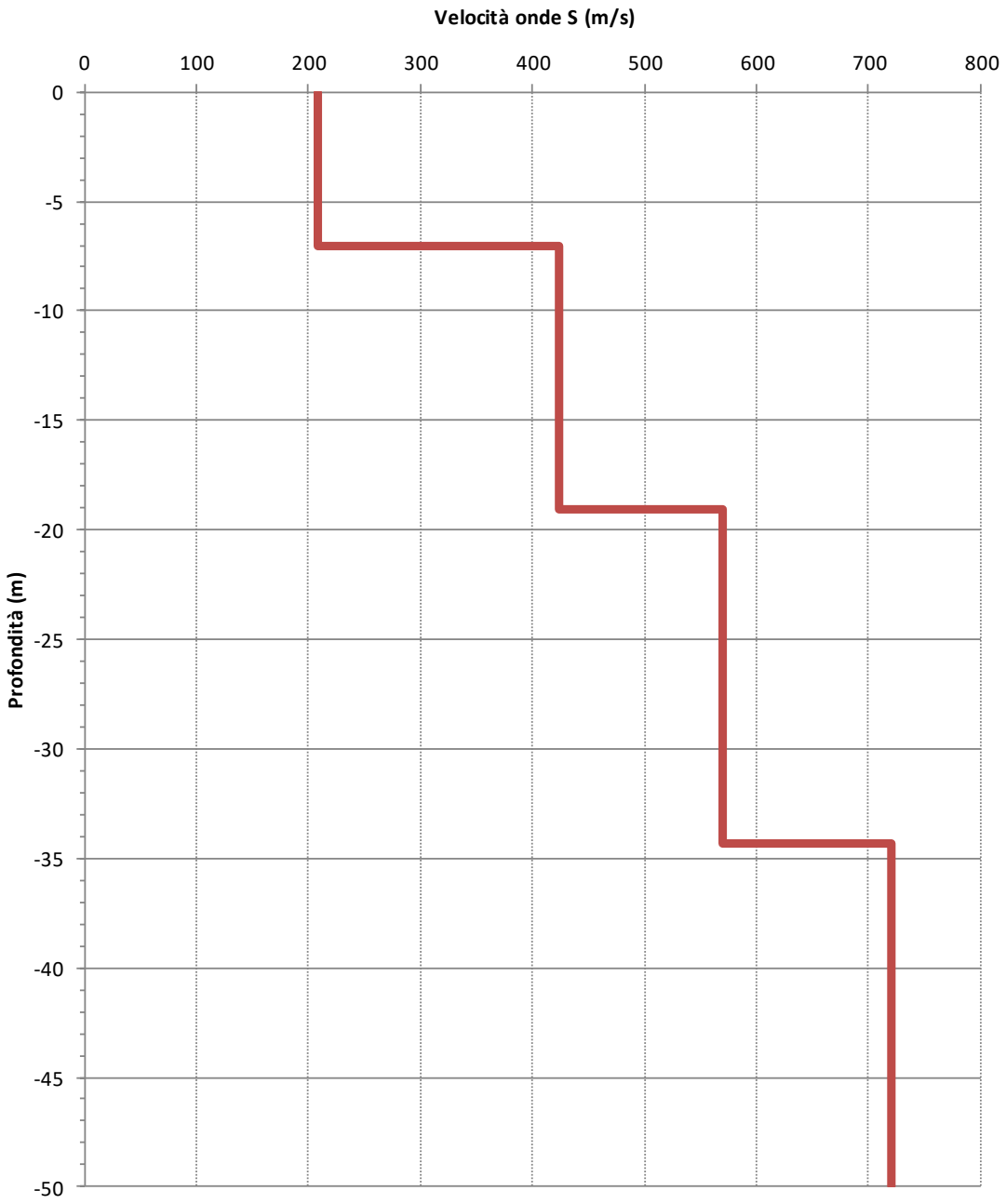


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	7,0	209
7,0	19,1	424
19,1	34,3	570
34,3	50	720

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **371 m/s**.

ESAC 5

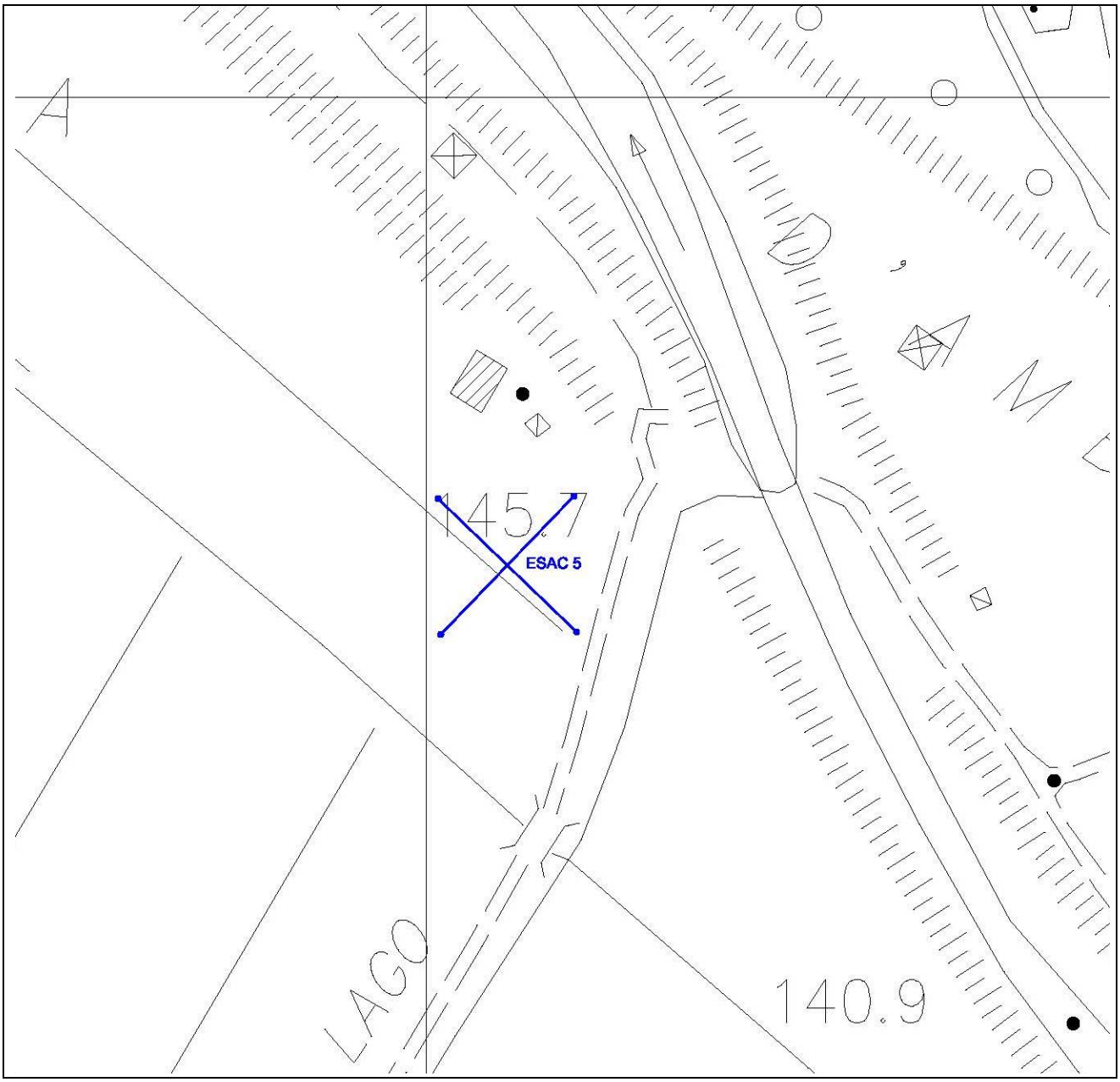


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

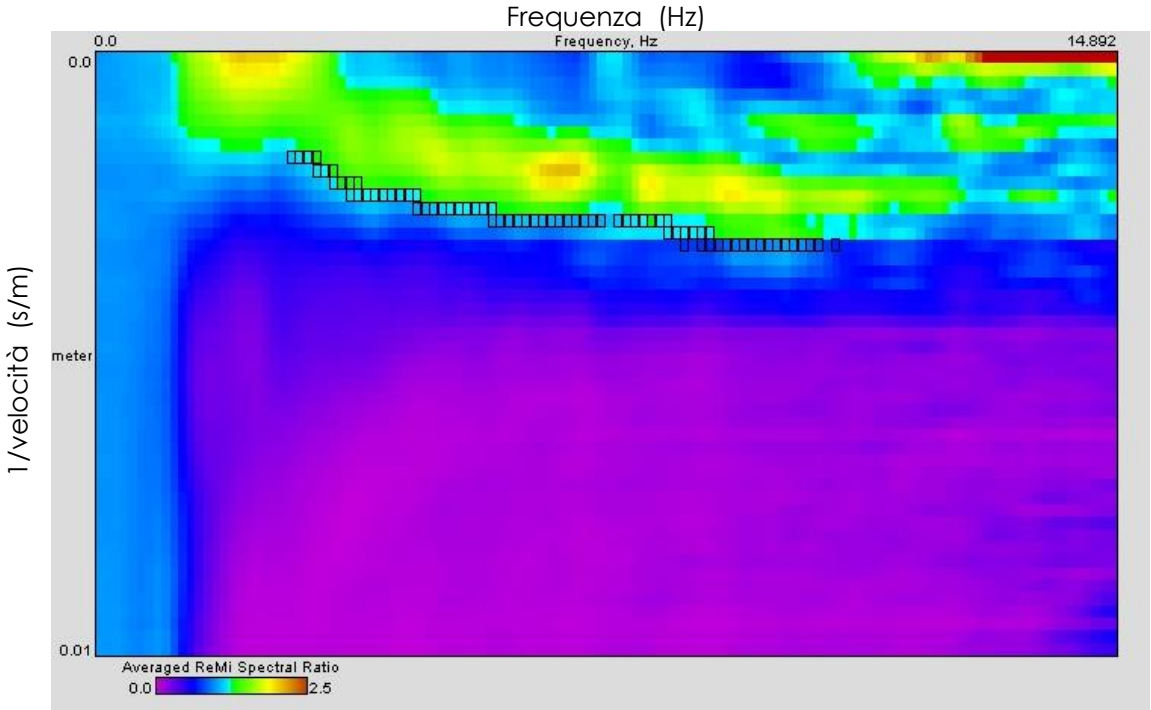


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

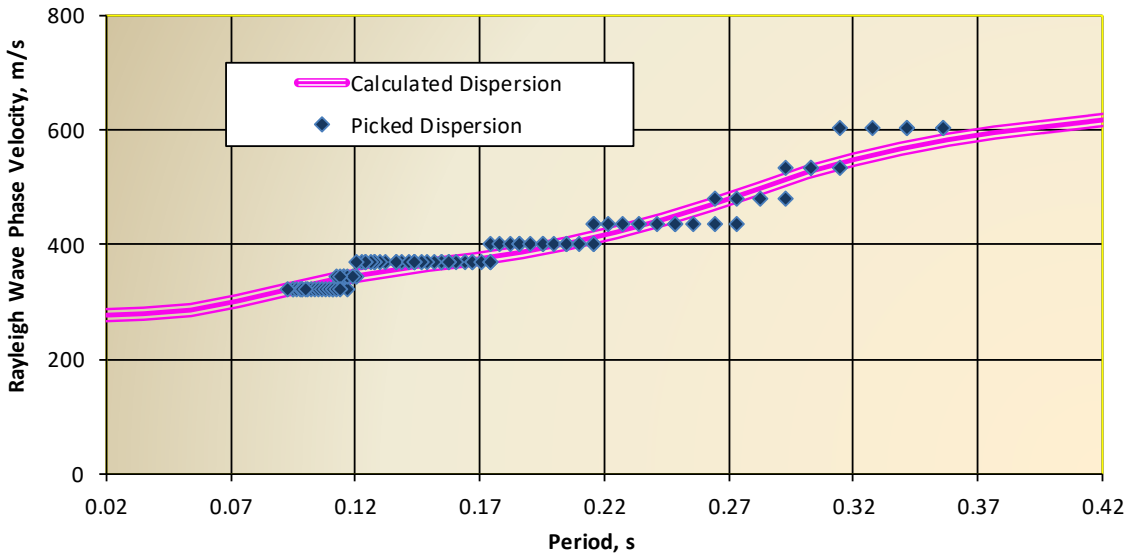


Figura: Diagramma periodo – velocità di fase

Montevarchi 5

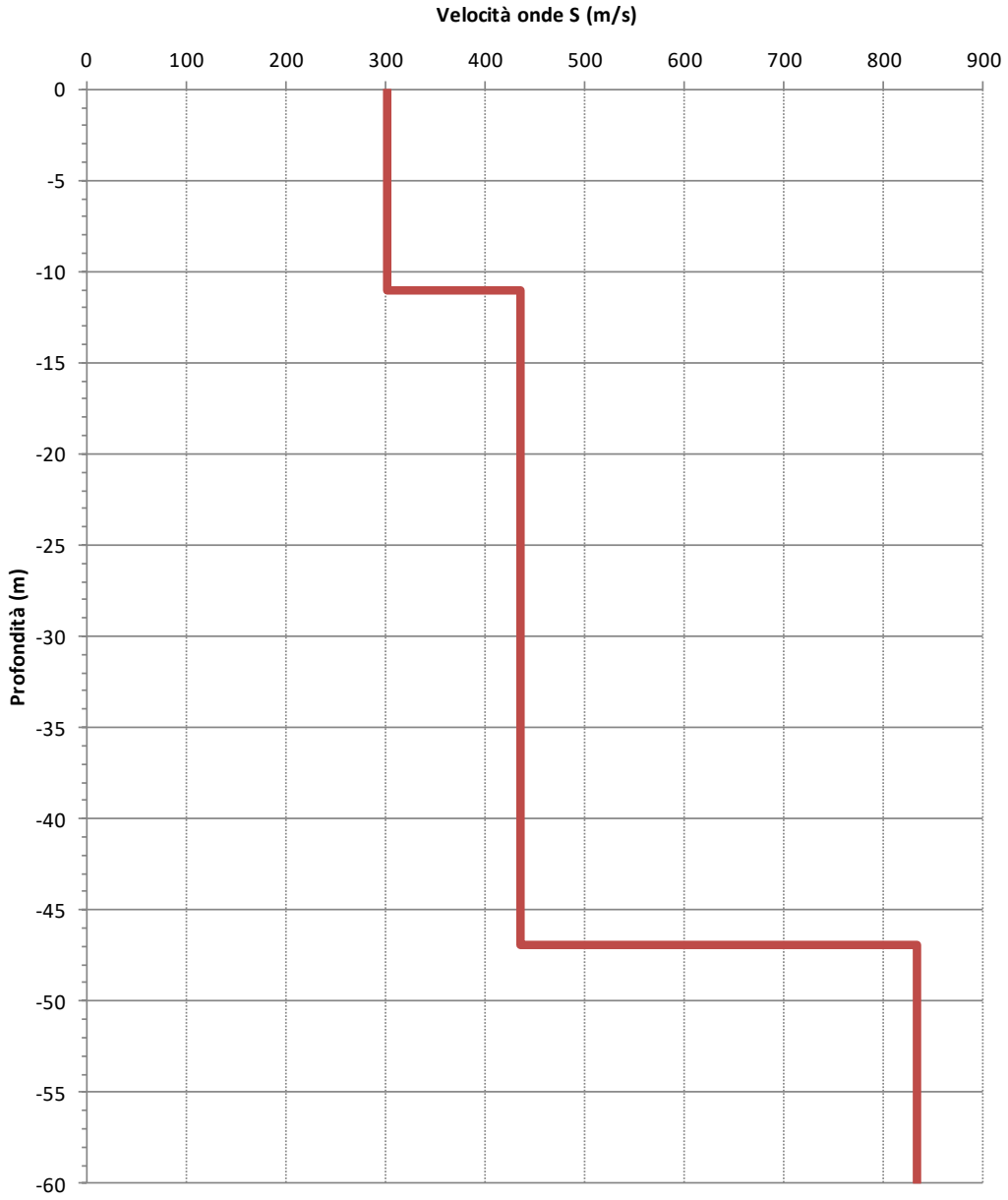


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	11,0	302
11,0	46,9	436
46,9	60	835

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **376 m/s**.

ESAC 6

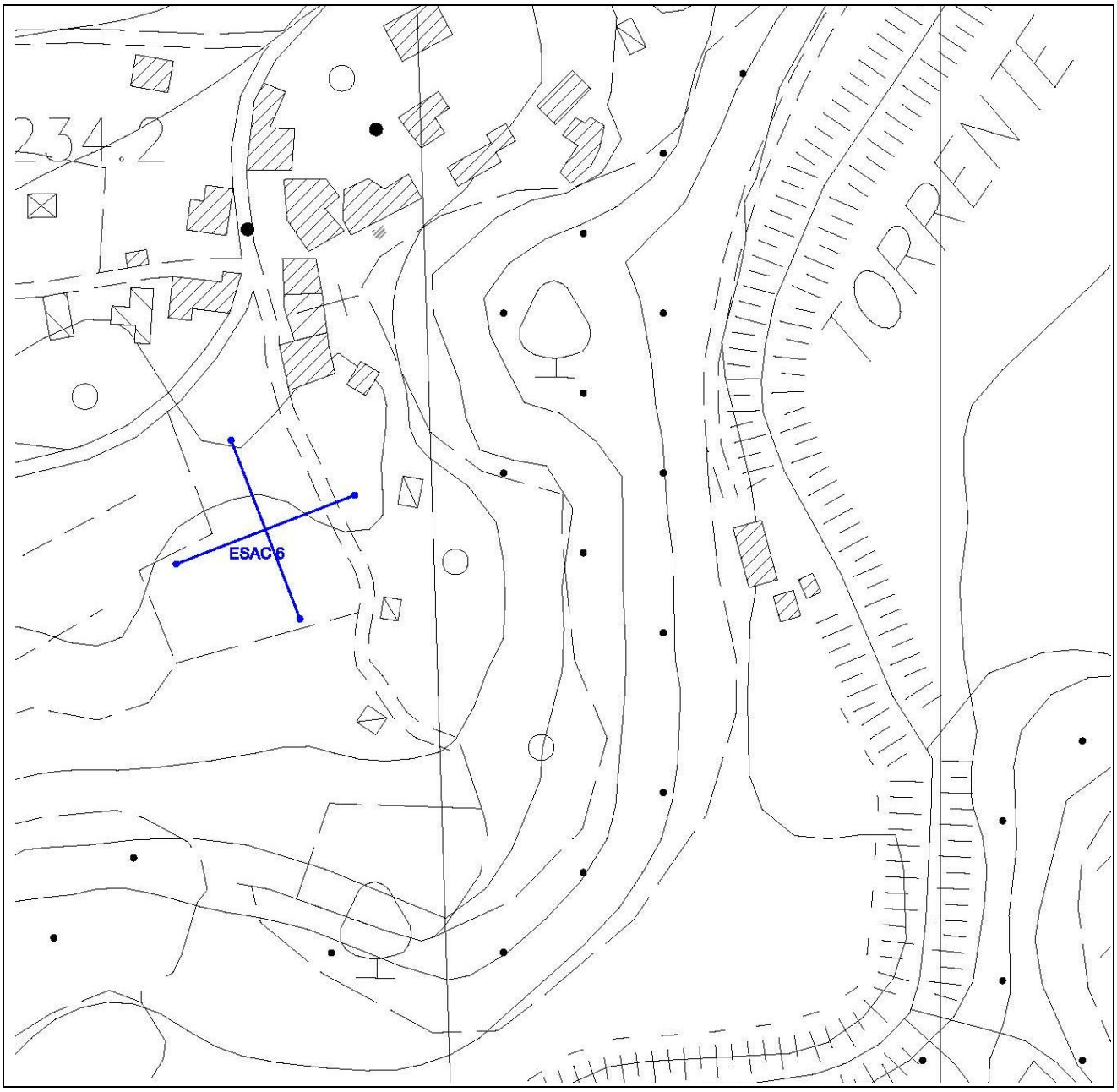


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

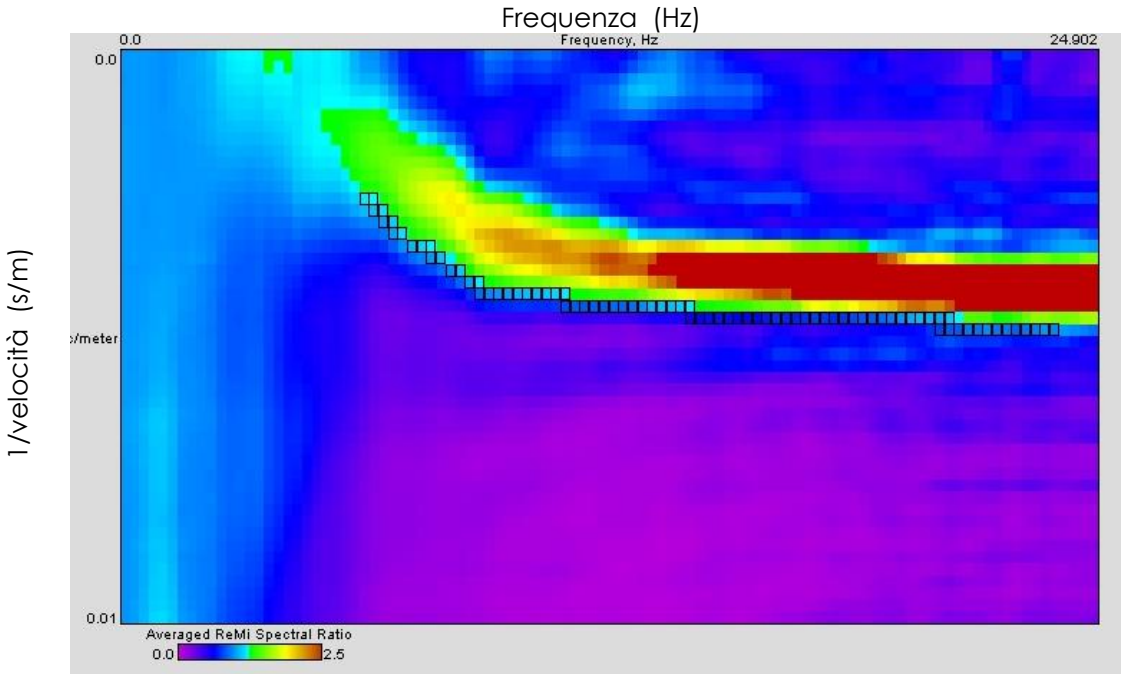


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

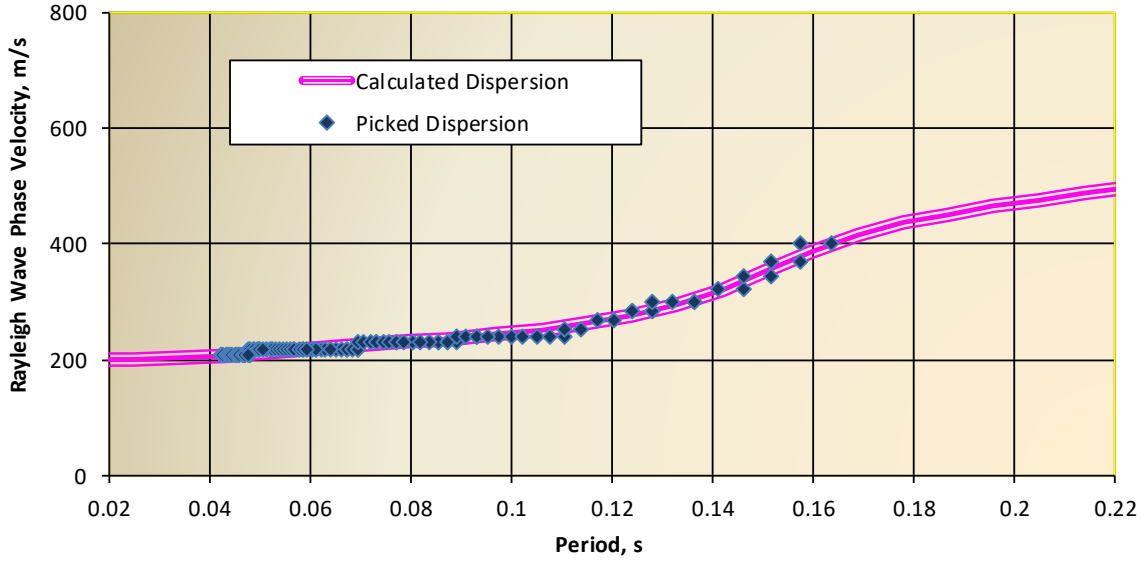


Figura: Diagramma periodo – velocità di fase

Montevarchi 6

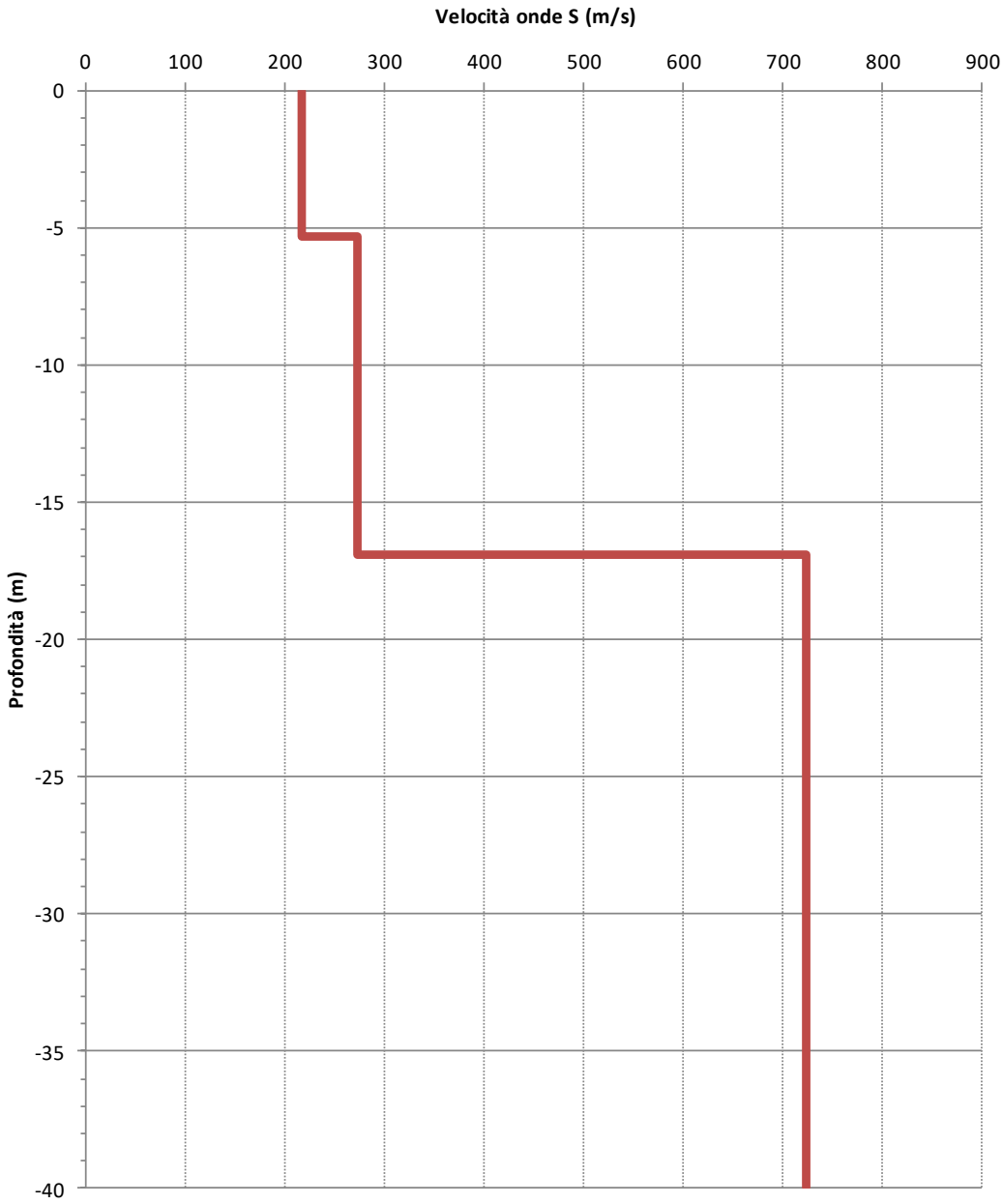


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	5,3	217
5,3	16,9	274
16,9	40	725

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **356 m/s**.

ESAC 7

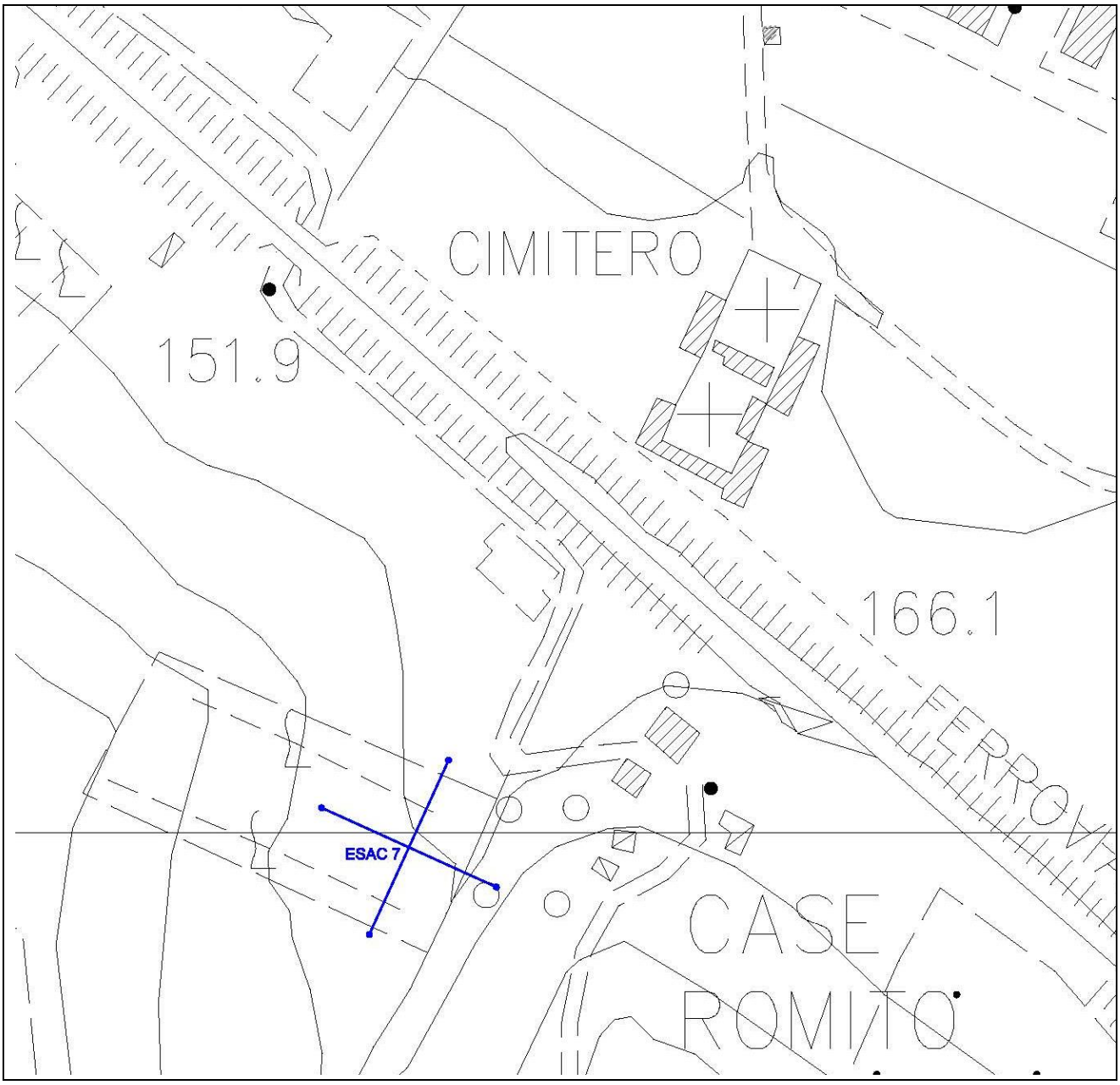


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

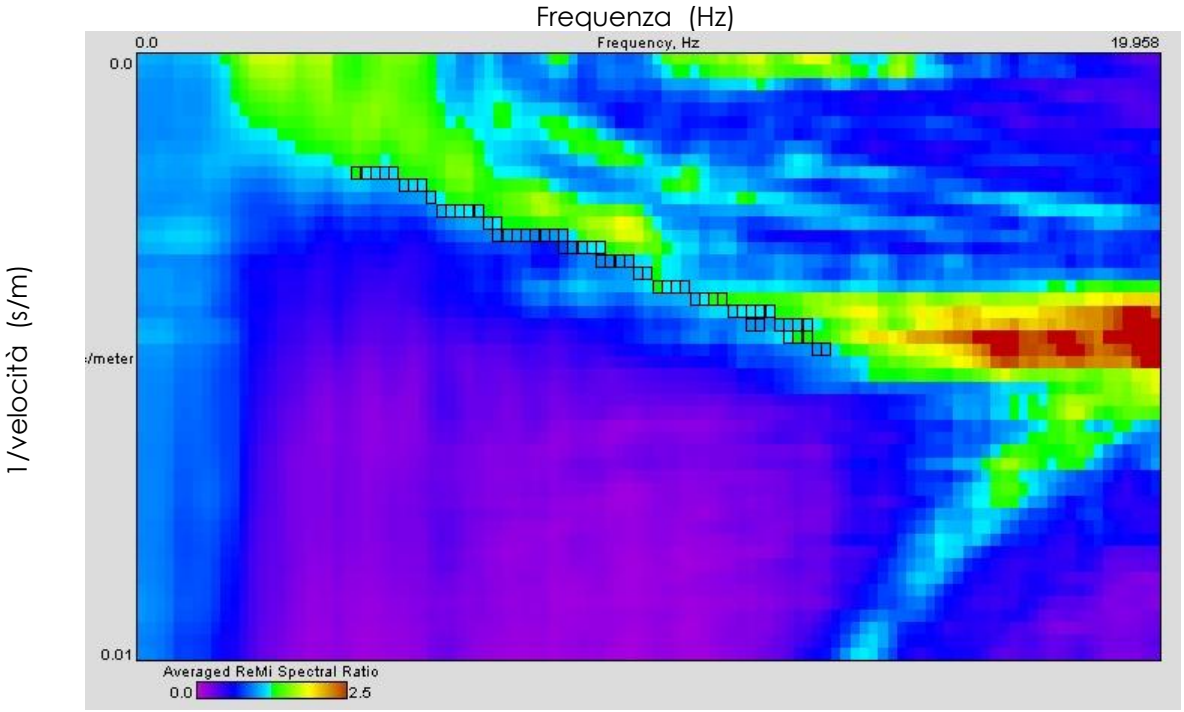


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

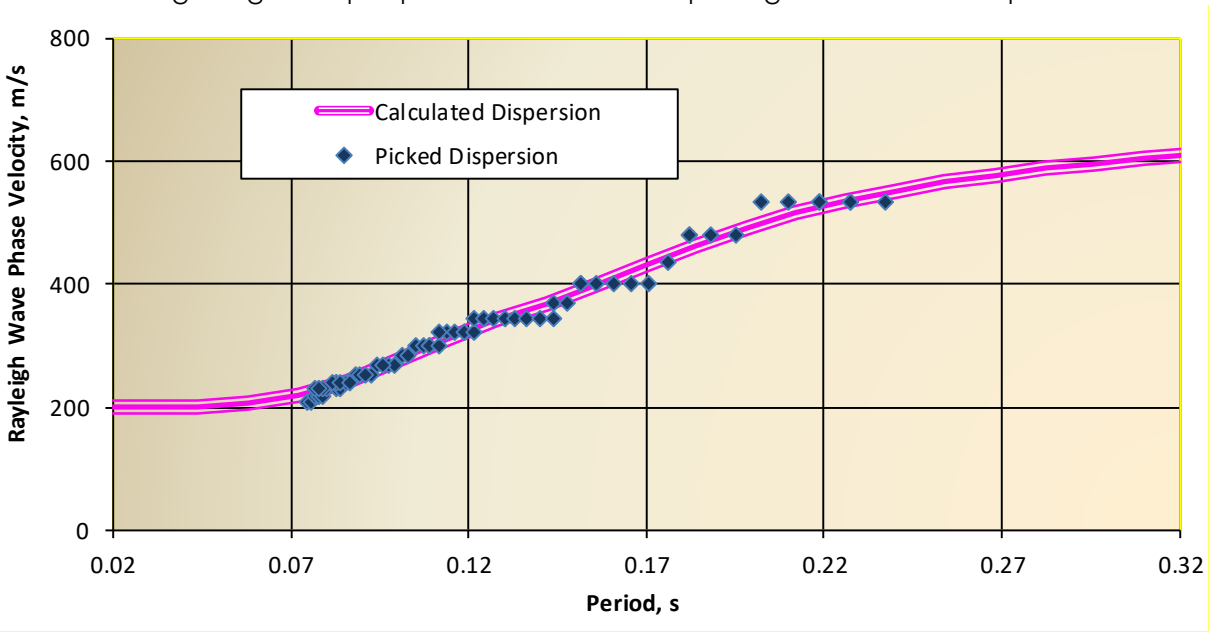


Figura: Diagramma periodo – velocità di fase

Montevarchi 7

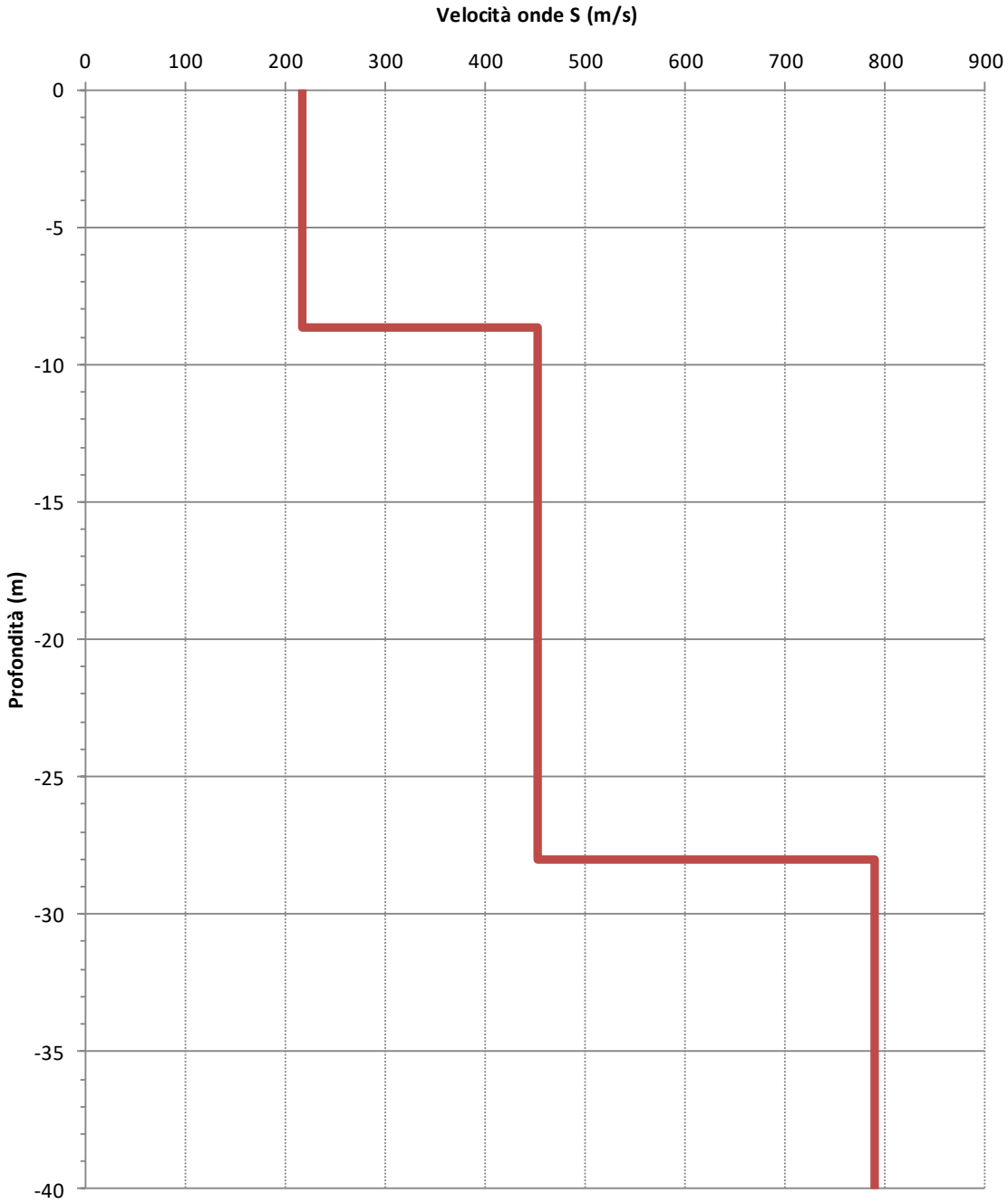


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	8,6	217
8,6	28,0	452
28,0	40	790

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **355 m/s**.

ESAC 8

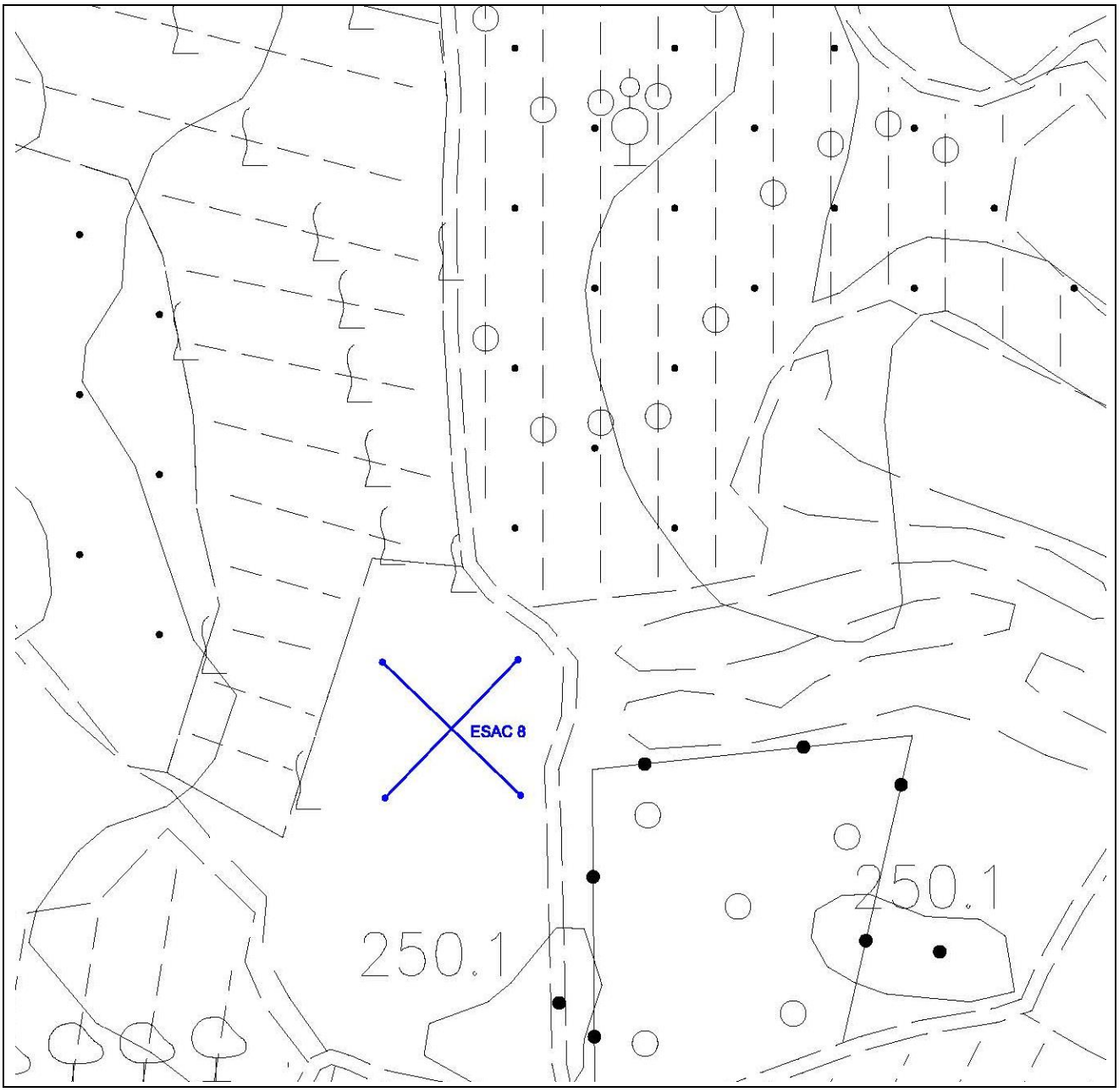


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

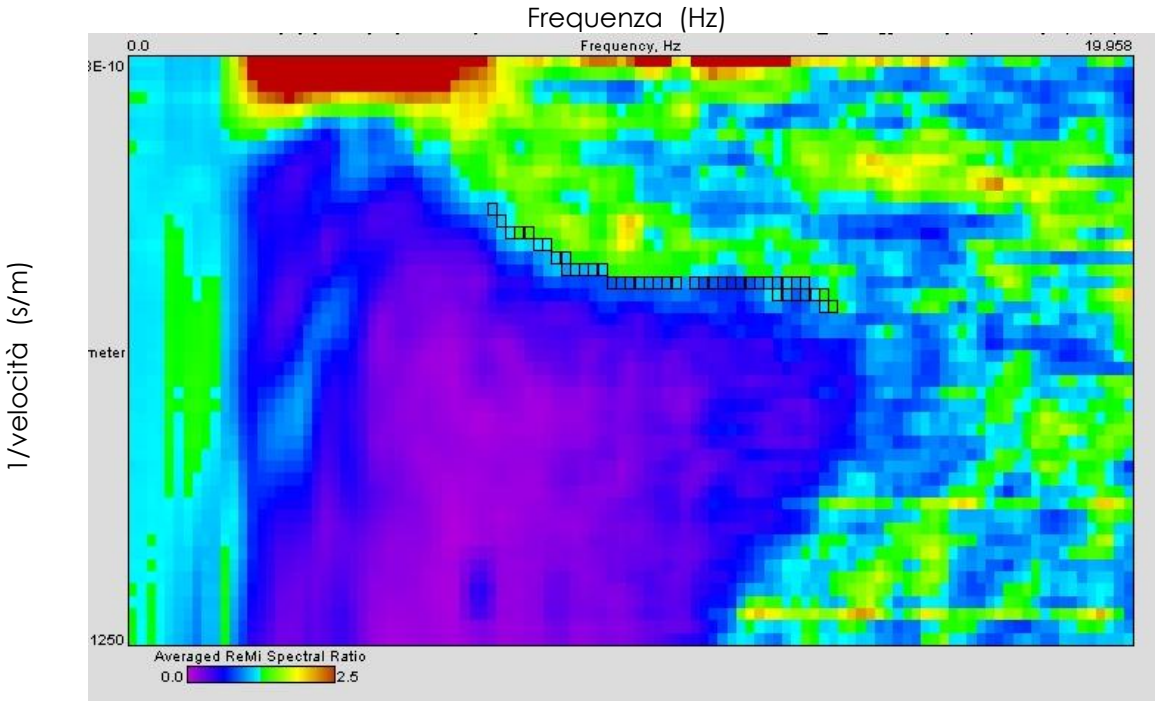


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

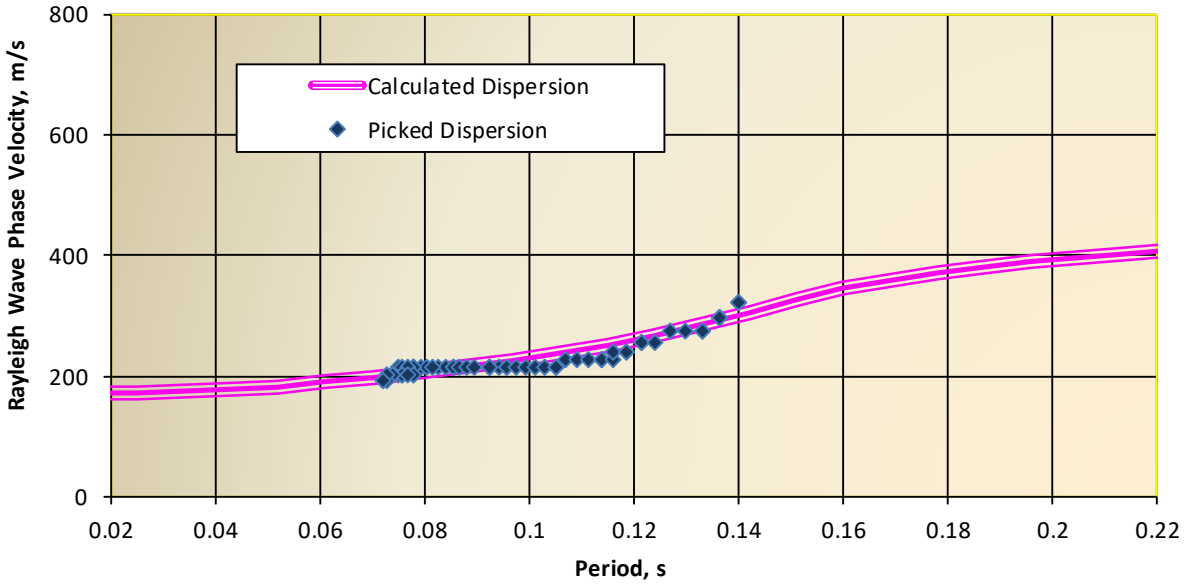


Figura: Diagramma periodo – velocità di fase

Montevarchi 8

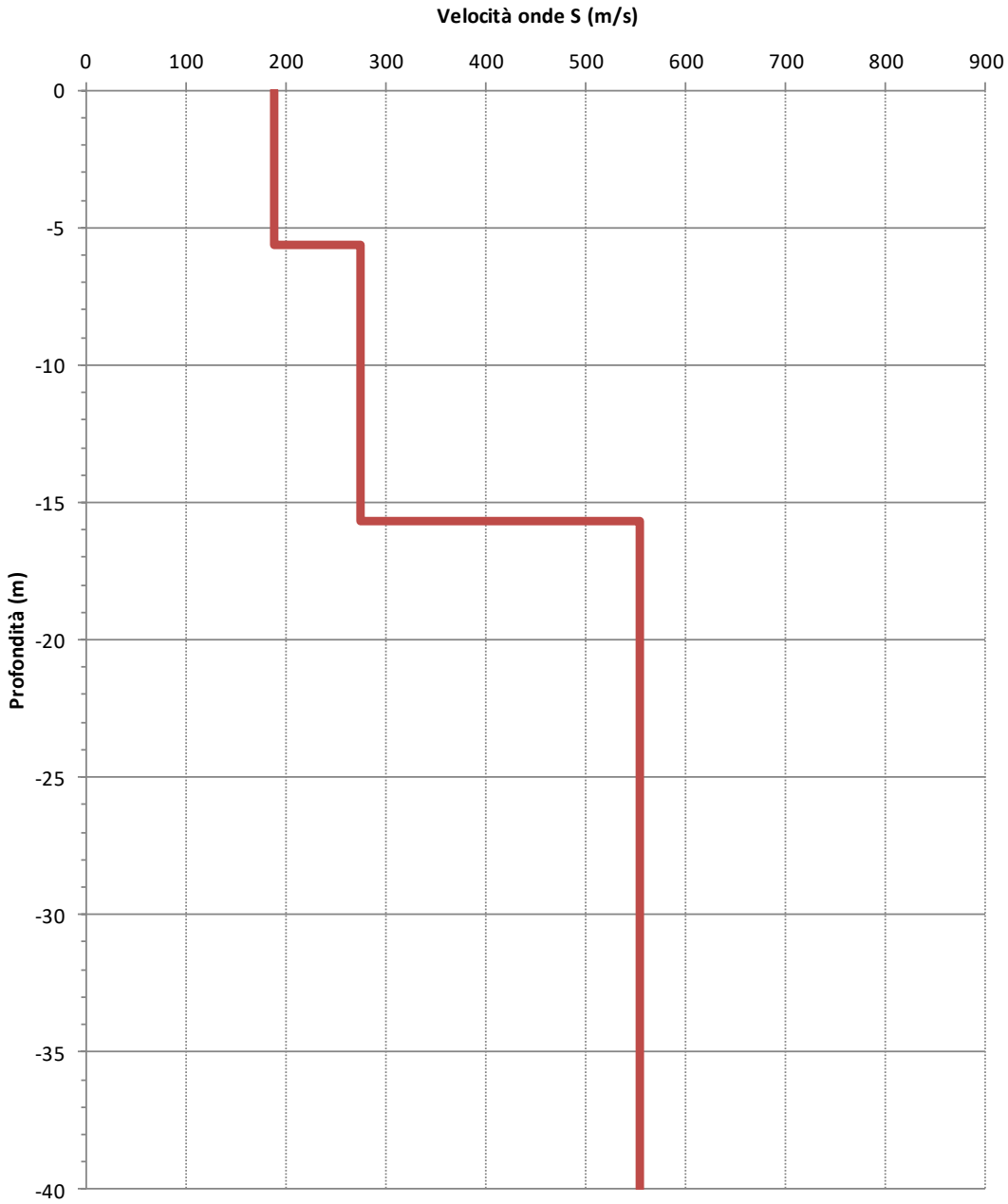


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	5,6	188
5,6	15,7	275
15,7	40	554

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **327 m/s**.

ESAC 9

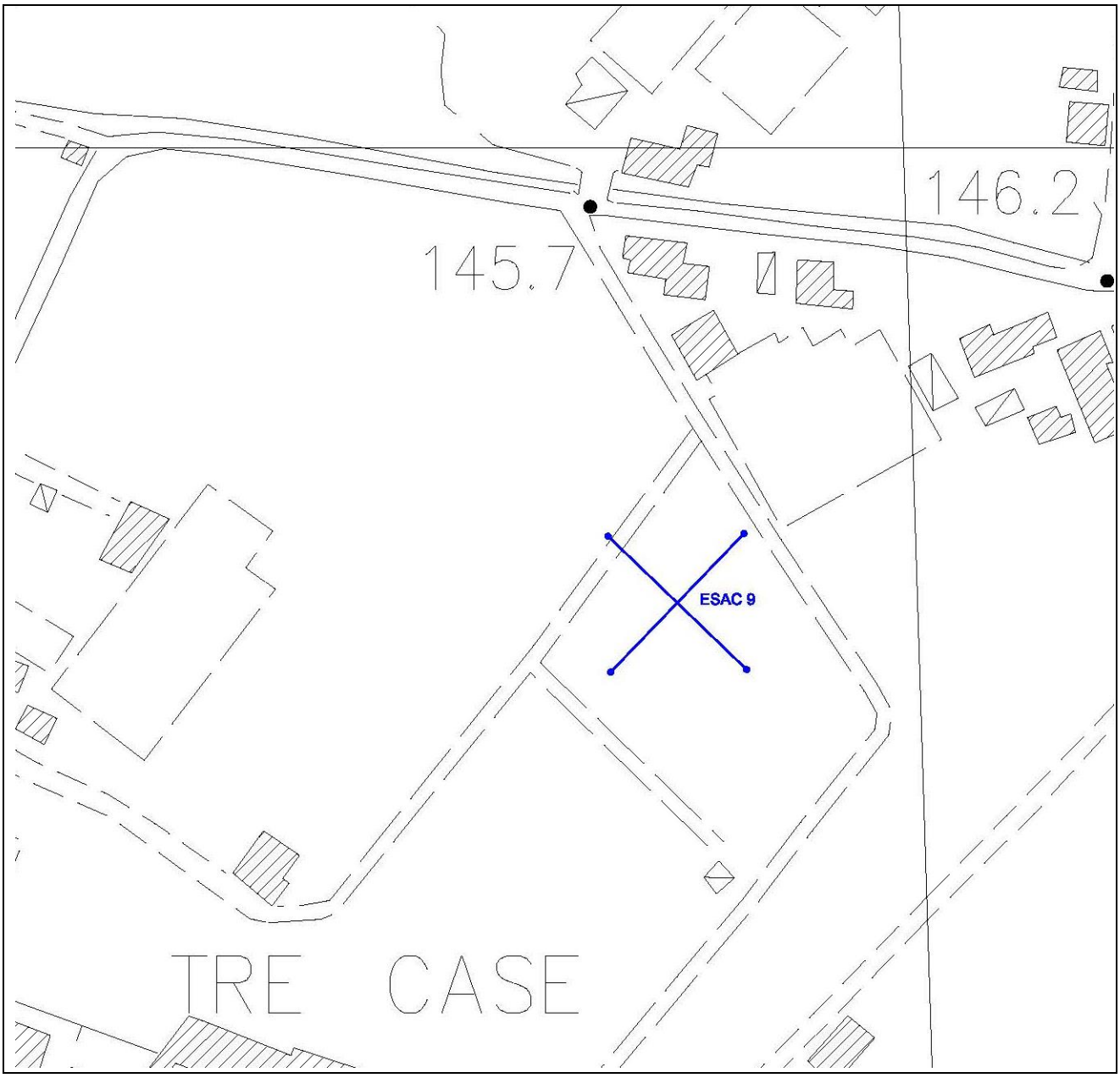


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

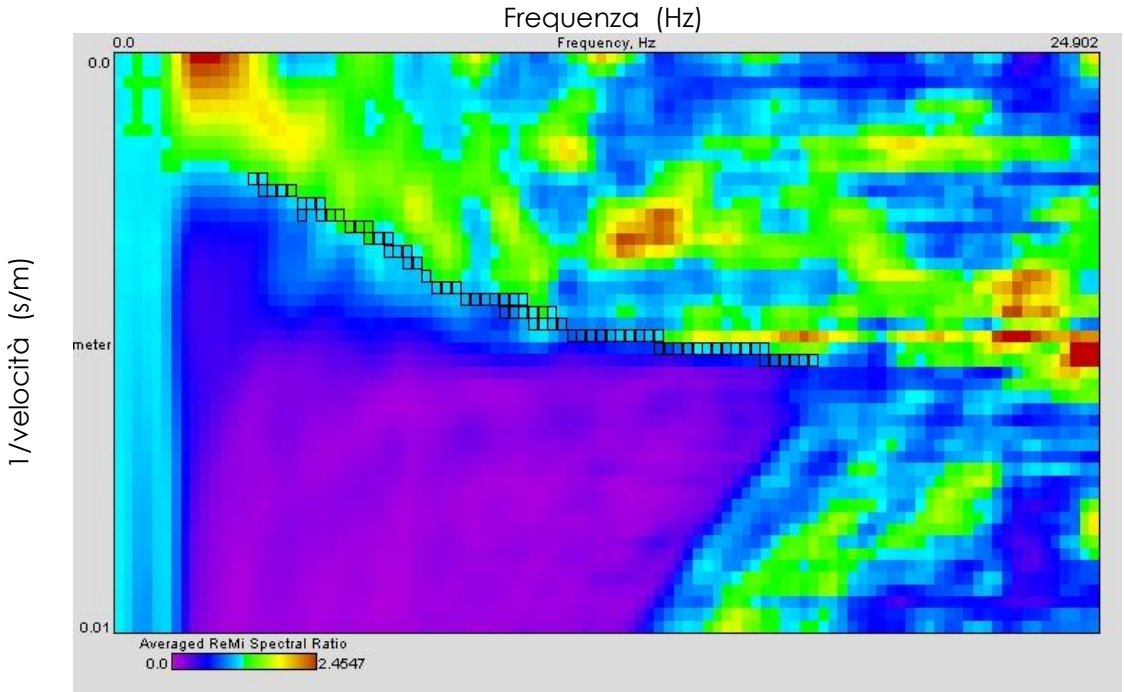


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

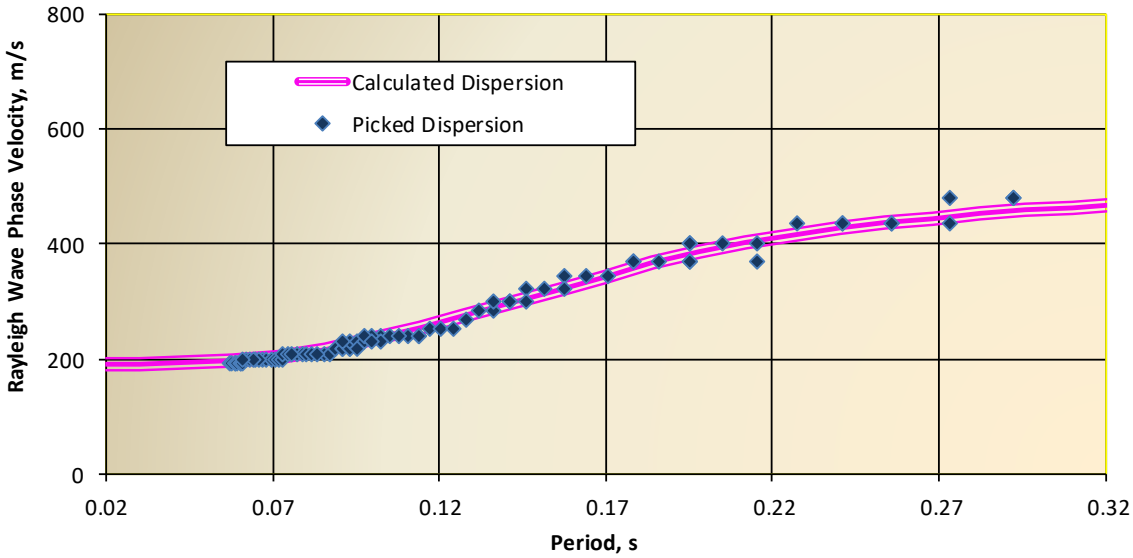


Figura: Diagramma periodo – velocità di fase

Montevarchi 9

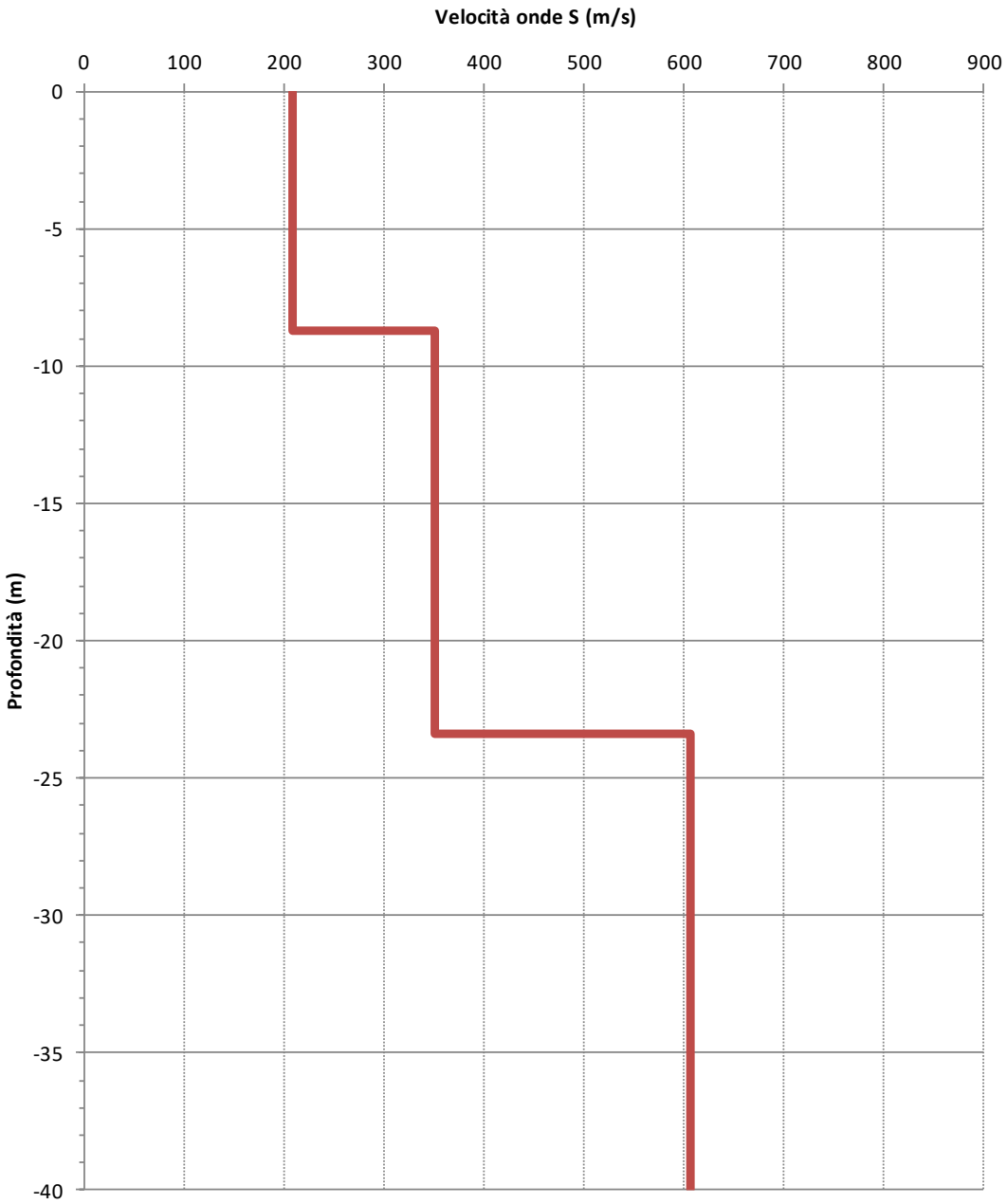


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	8,7	208
8,7	23,4	351
23,4	40	607

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **320 m/s**.

ESAC 10

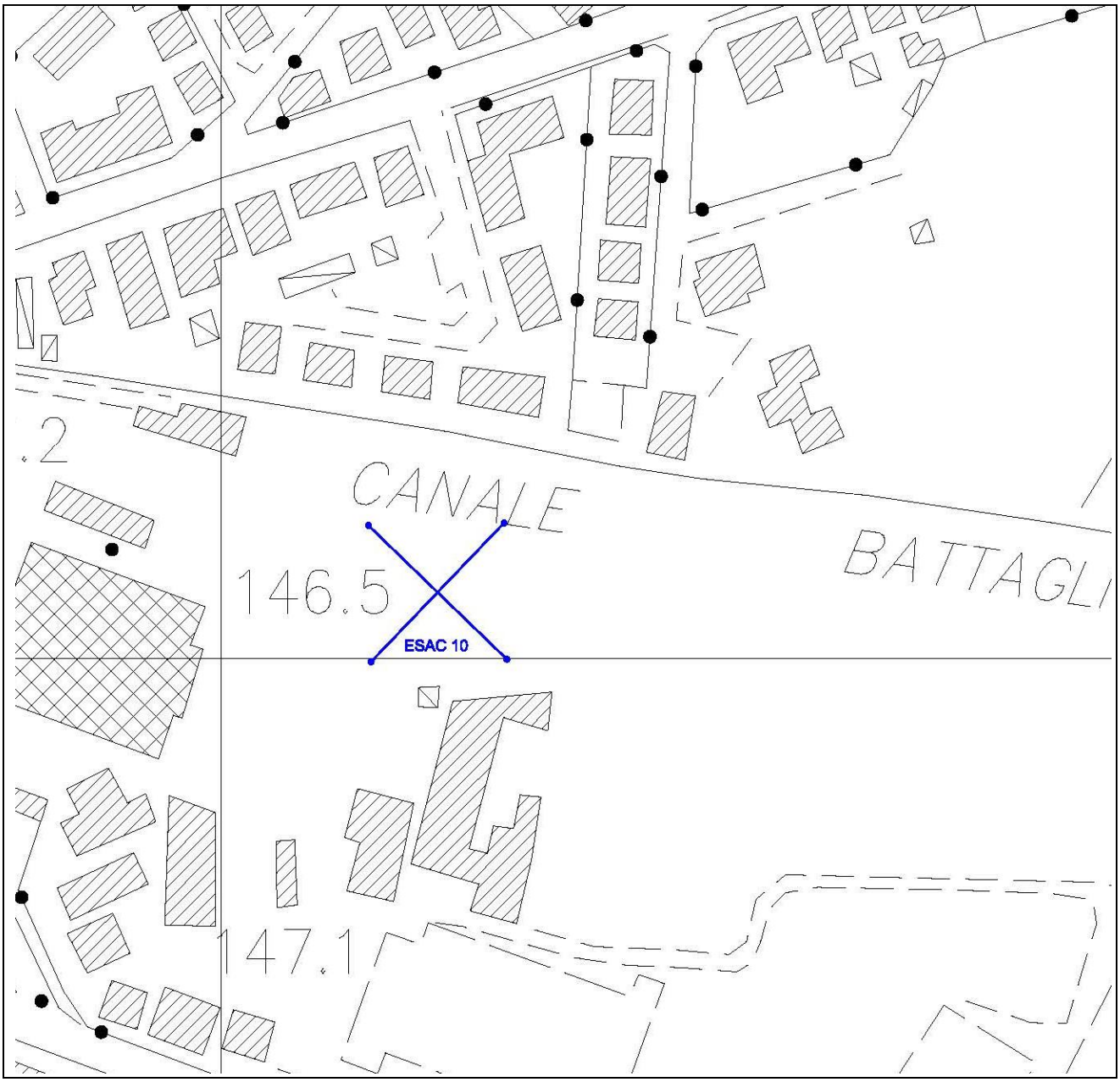


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

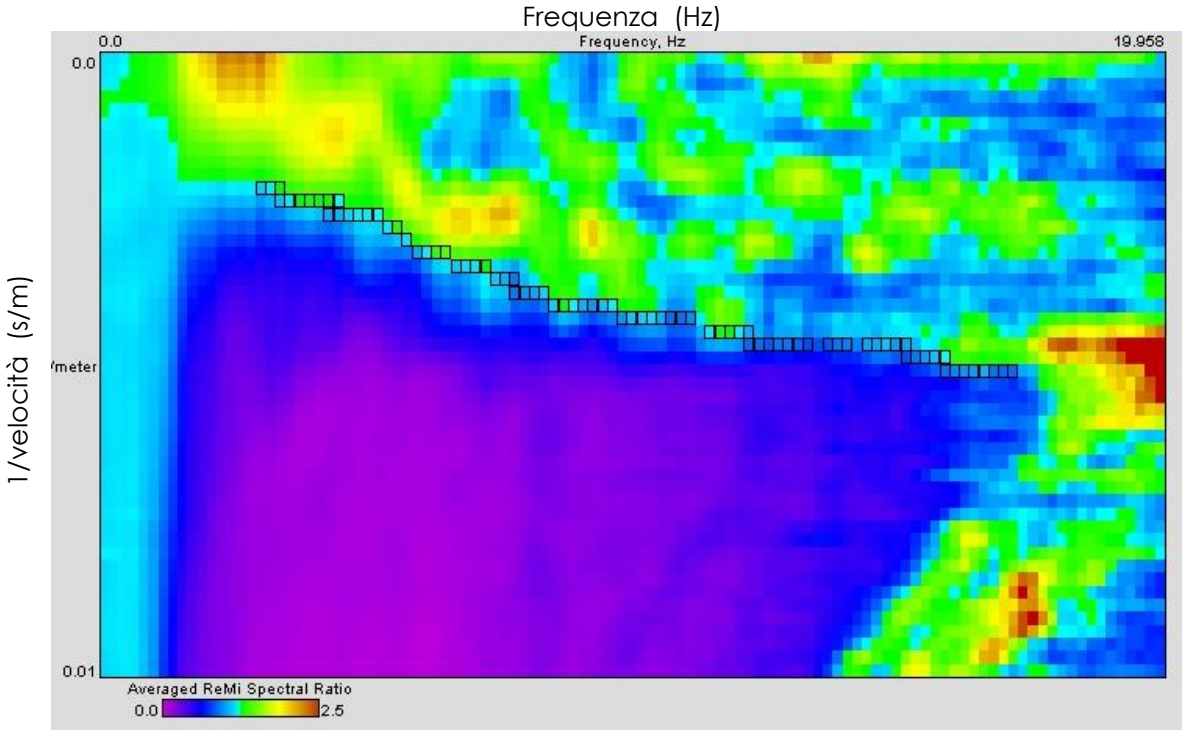


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

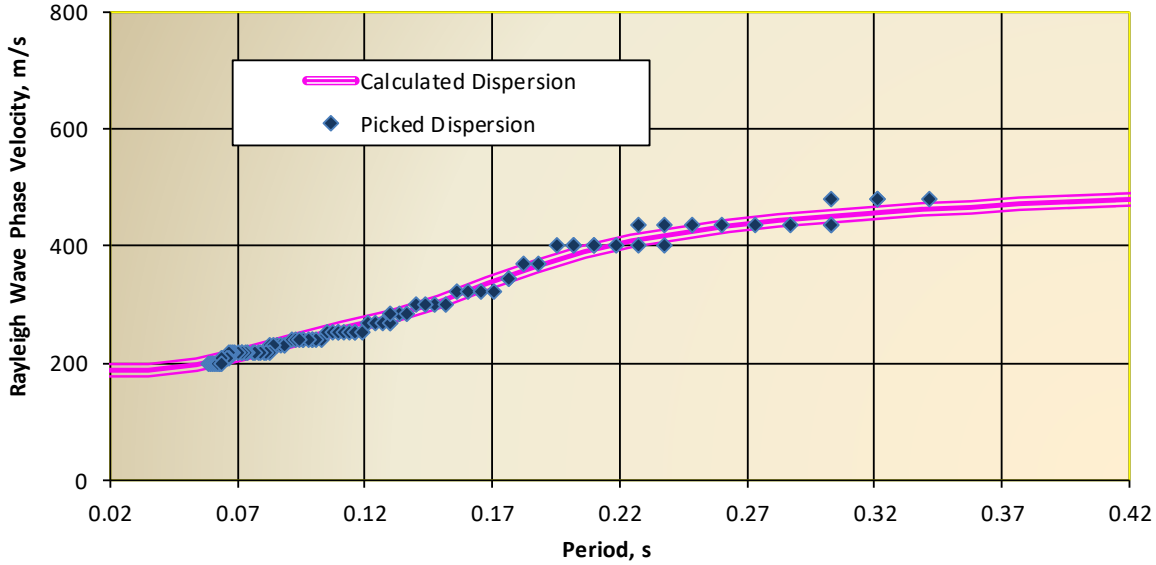


Figura: Diagramma periodo – velocità di fase

Montevarchi 10

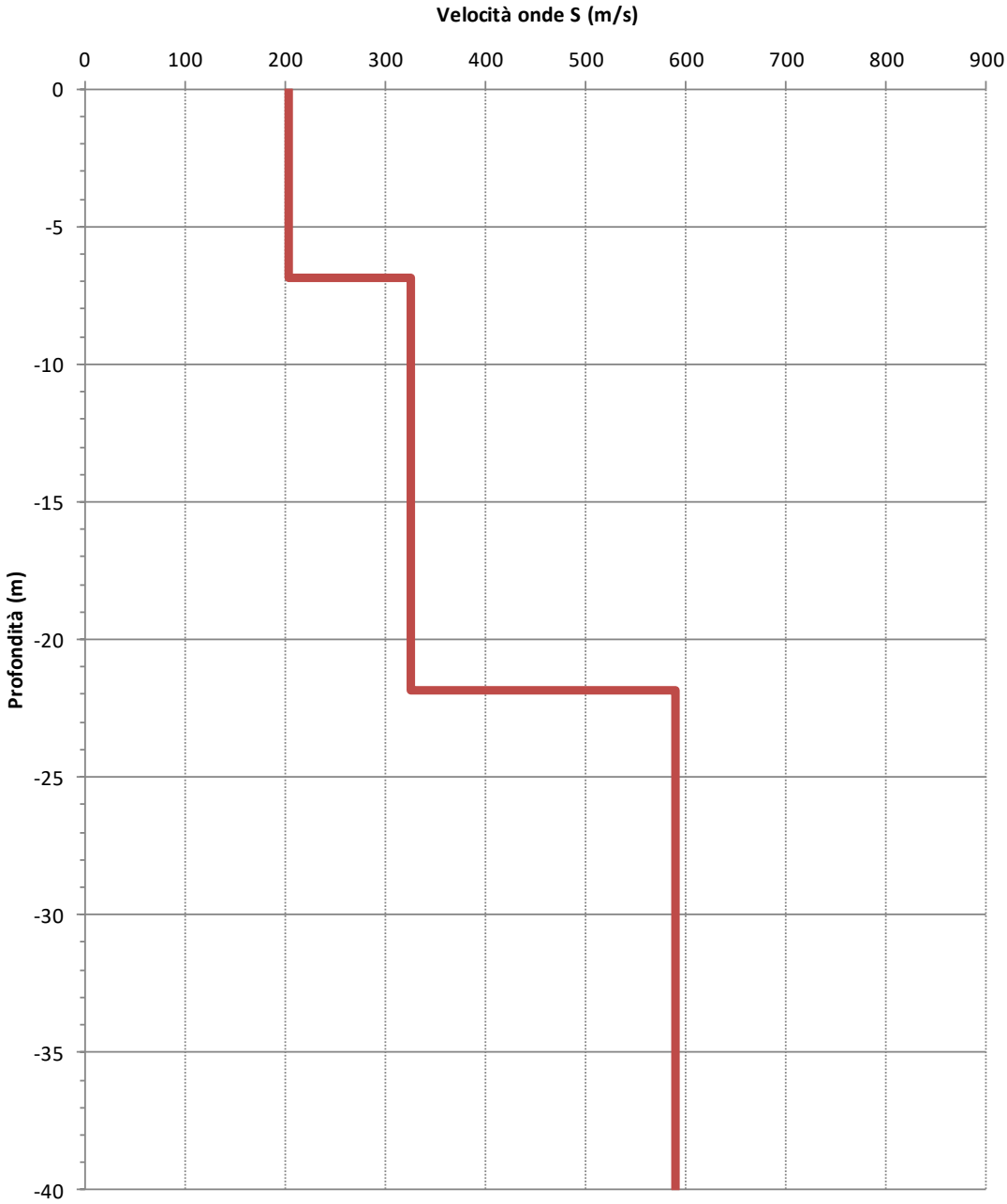


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	6,8	204
6,8	21,9	326
21,9	40	591

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **324 m/s**.

ESAC 11

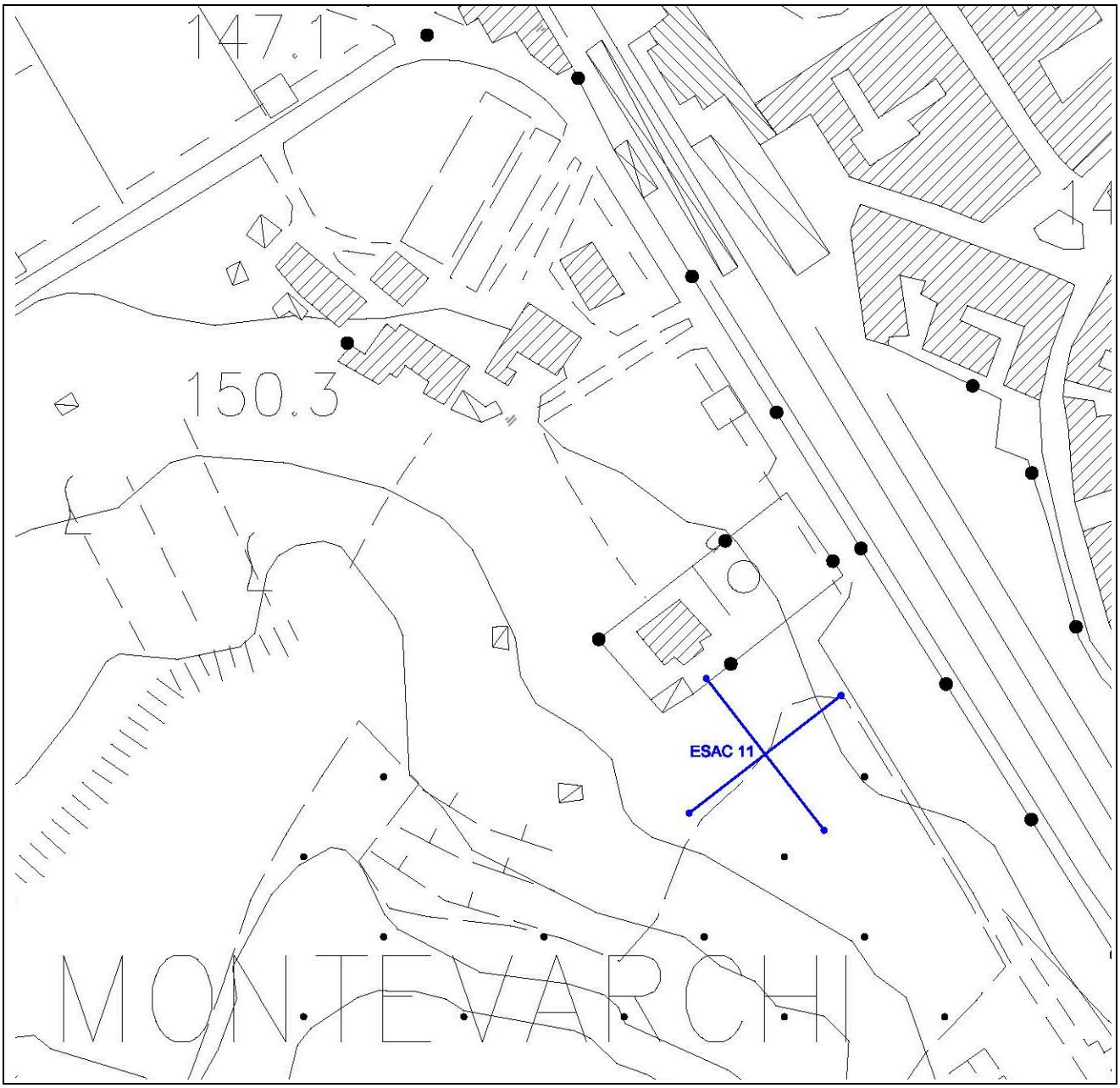


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

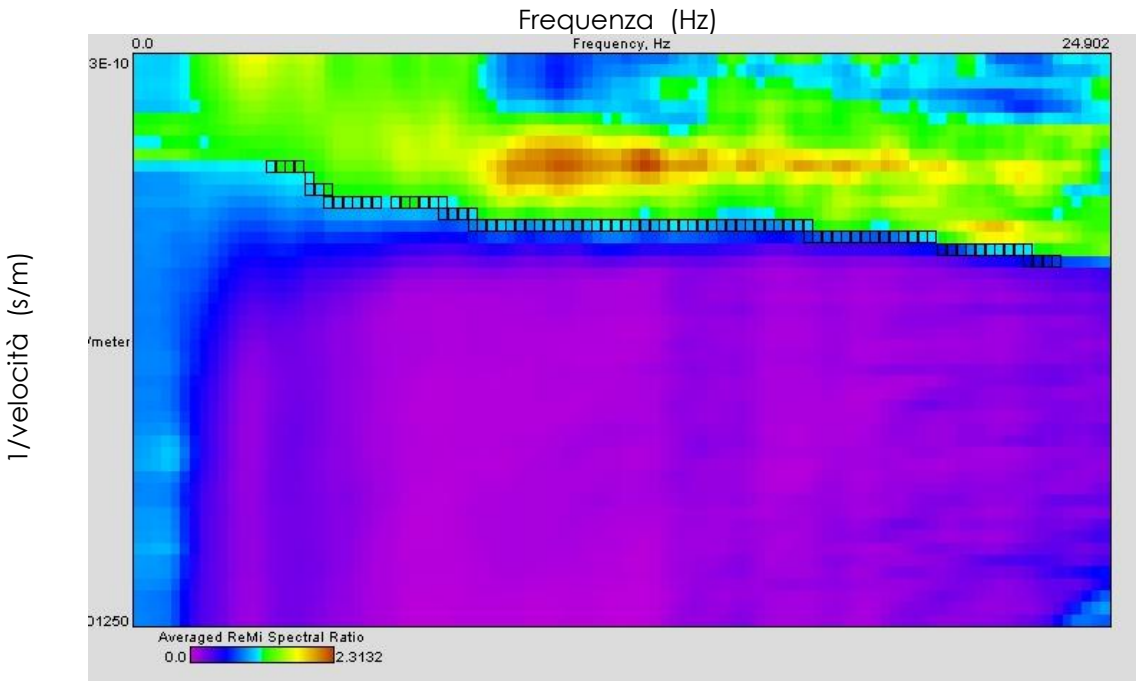


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

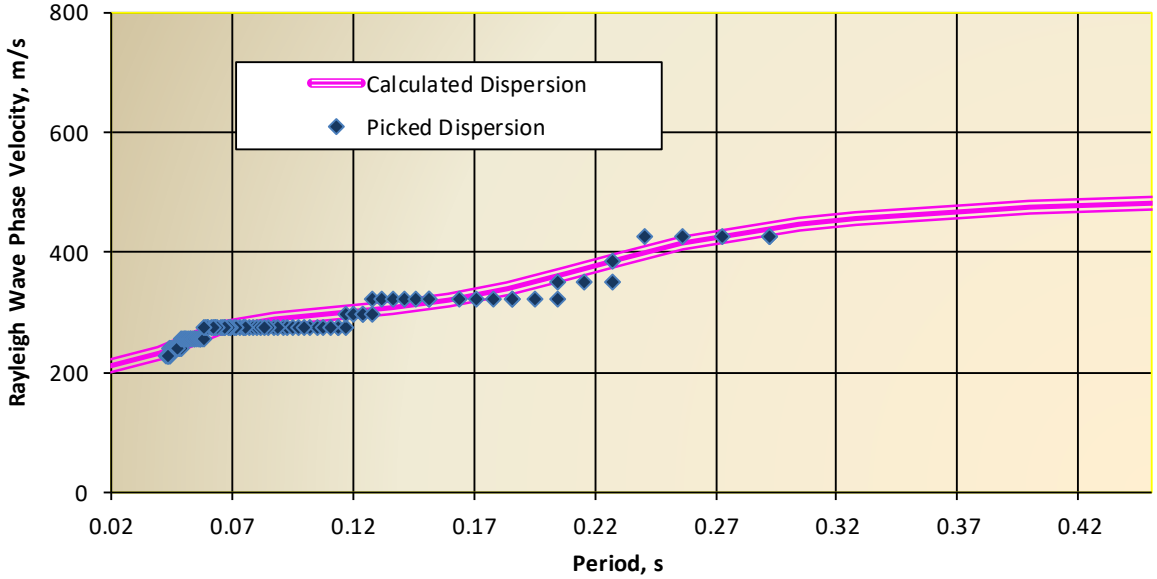


Figura: Diagramma periodo – velocità di fase

Montevarchi 11

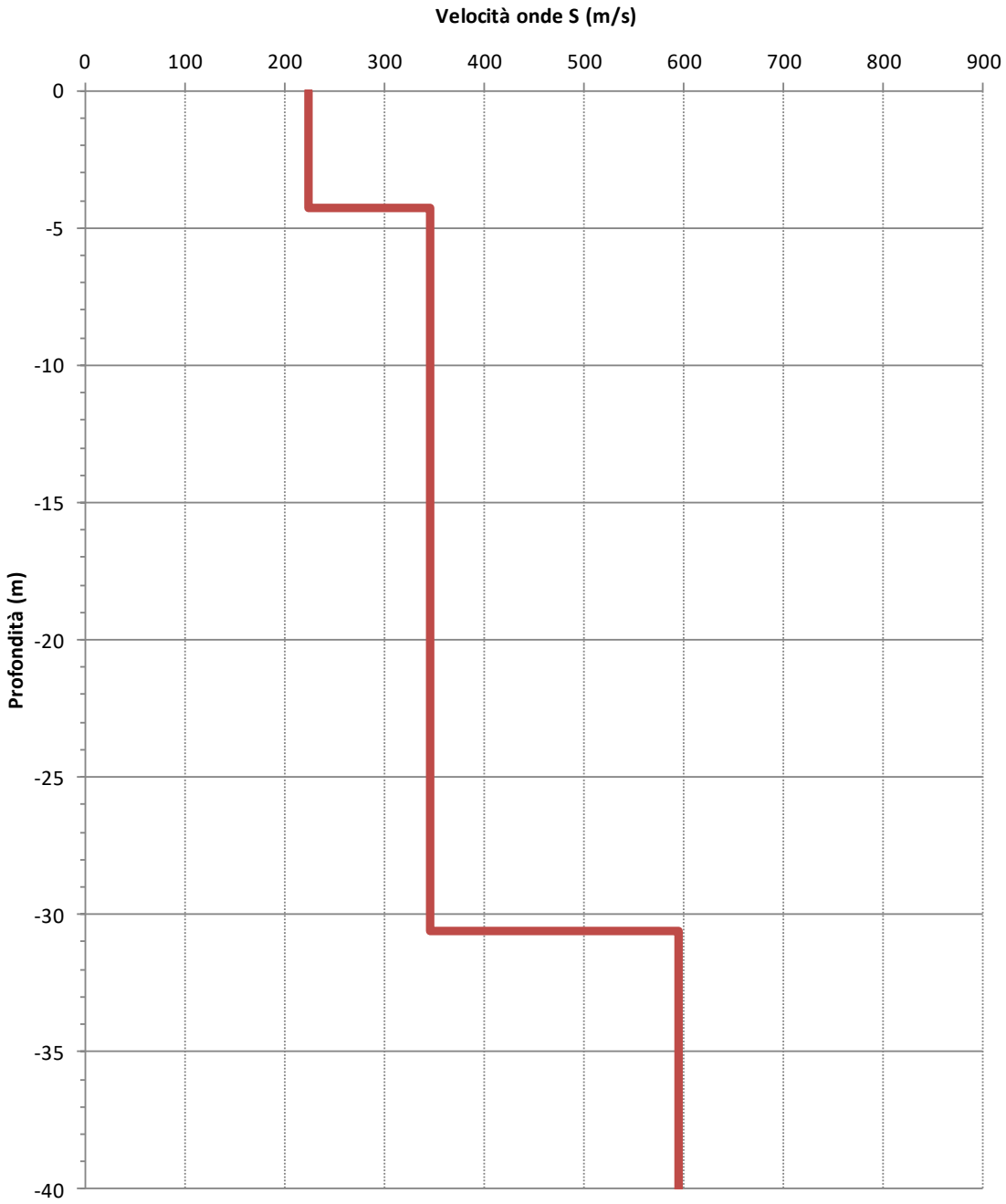


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	4,3	225
4,3	30,6	347
30,6	40	595

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **322 m/s**.

ESAC 12

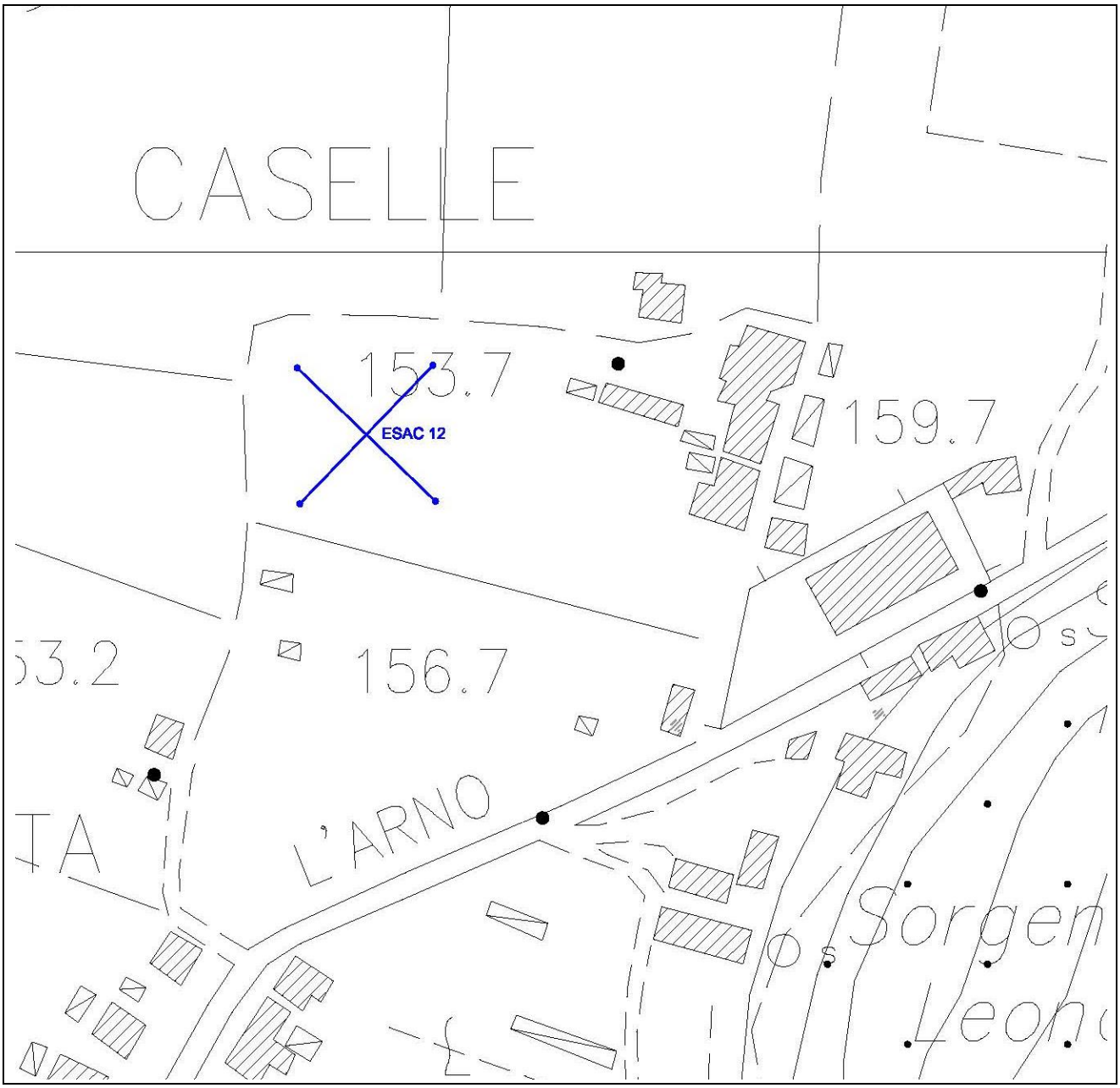


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

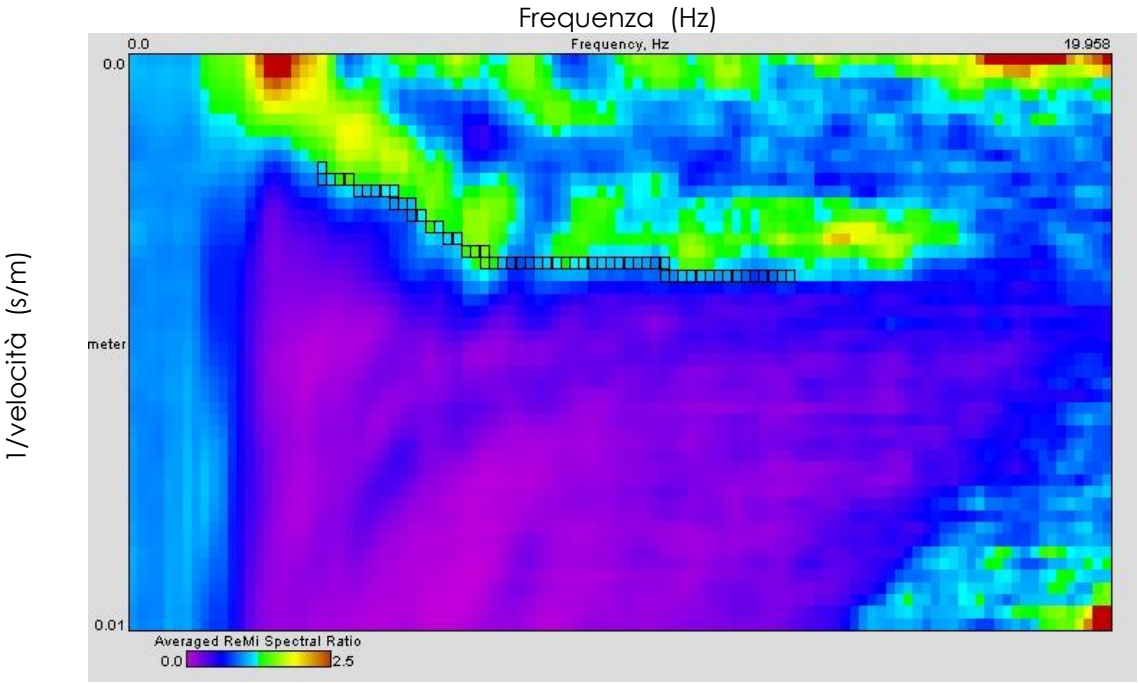


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

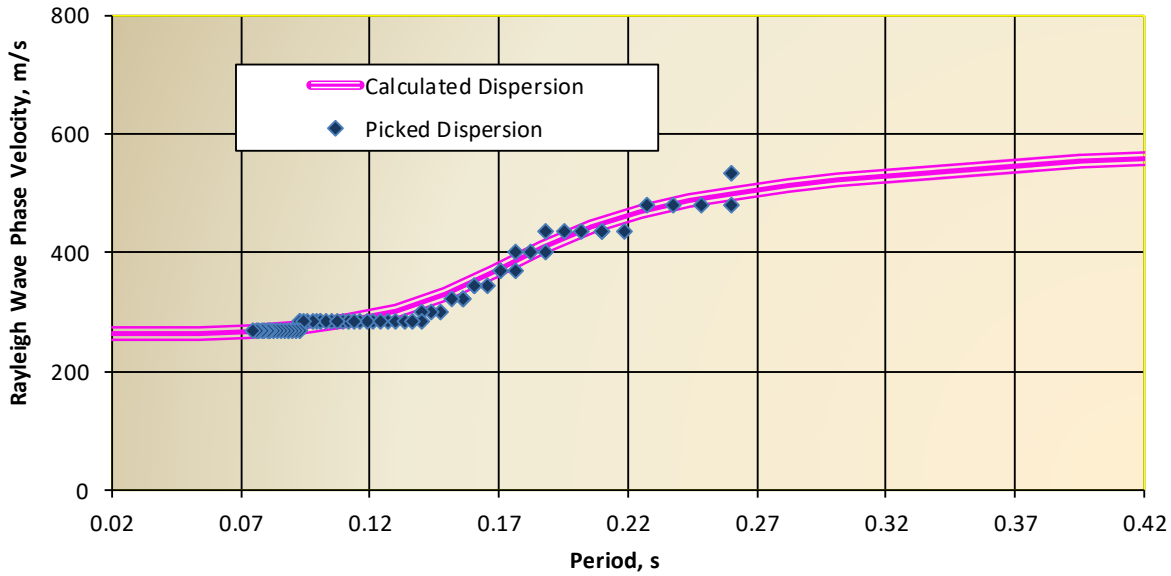


Figura: Diagramma periodo – velocità di fase

Montevarchi 12

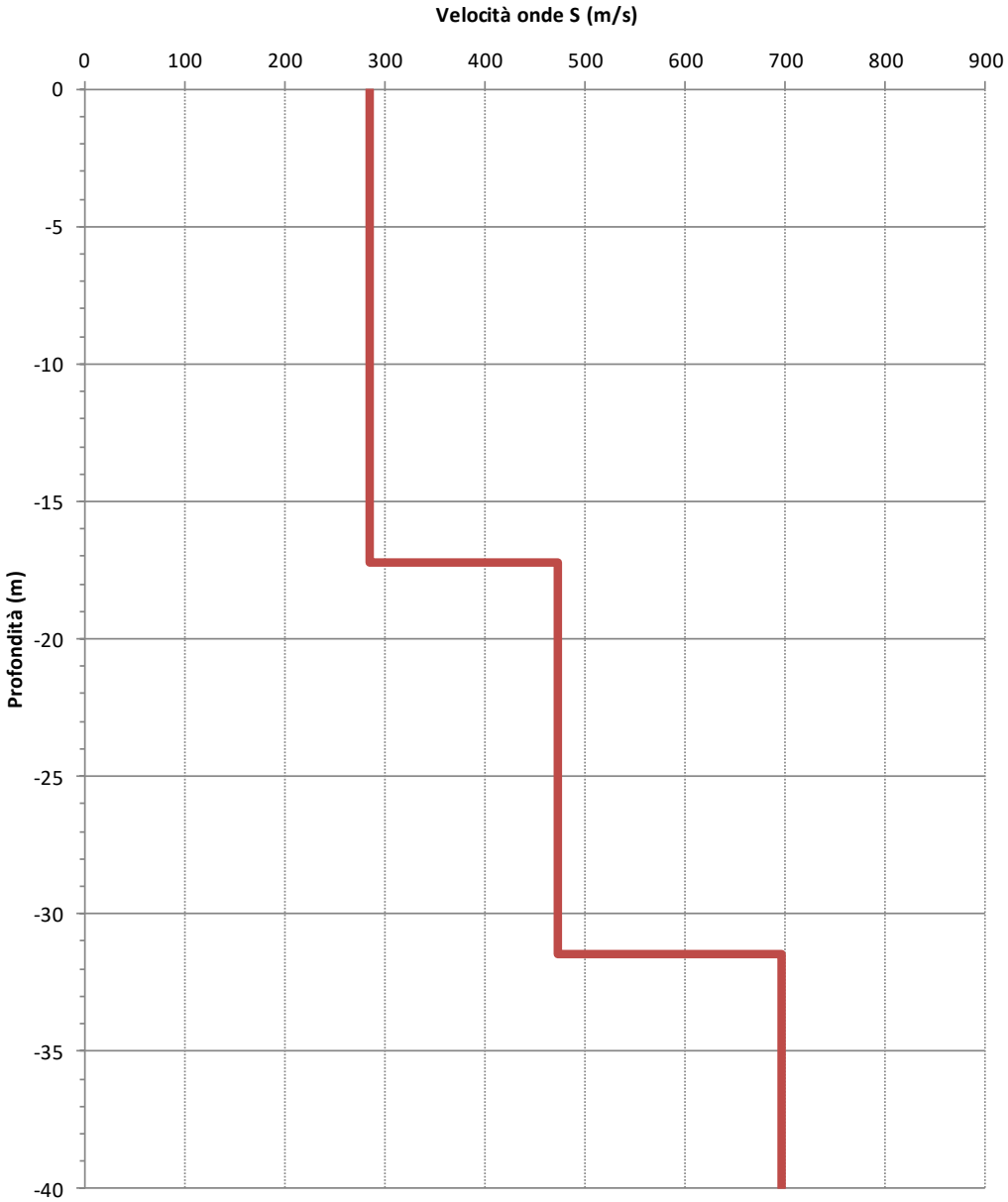


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	17,2	286
17,2	31,4	473
31,4	40	696

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **345 m/s**.

ESAC 13

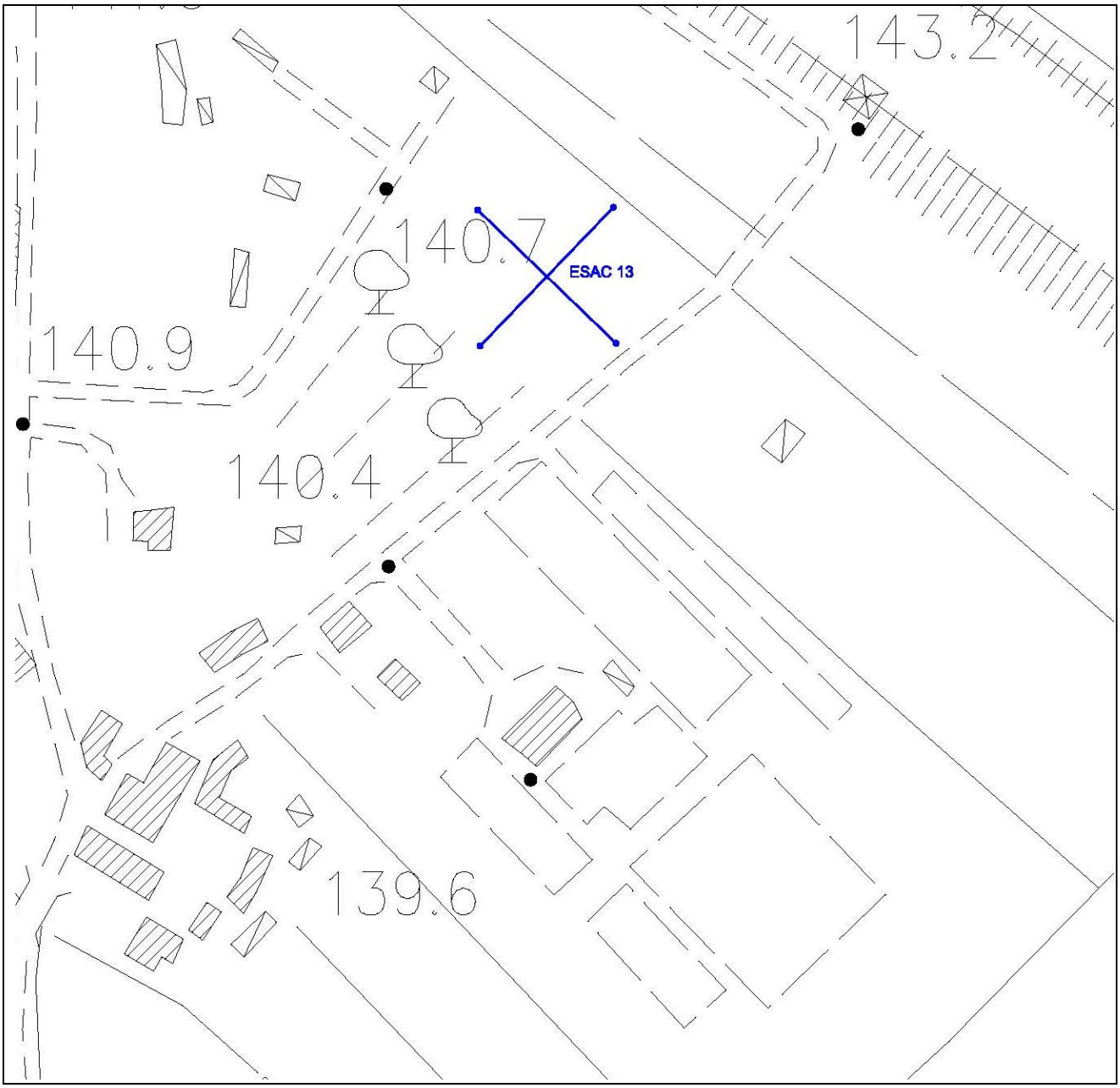


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

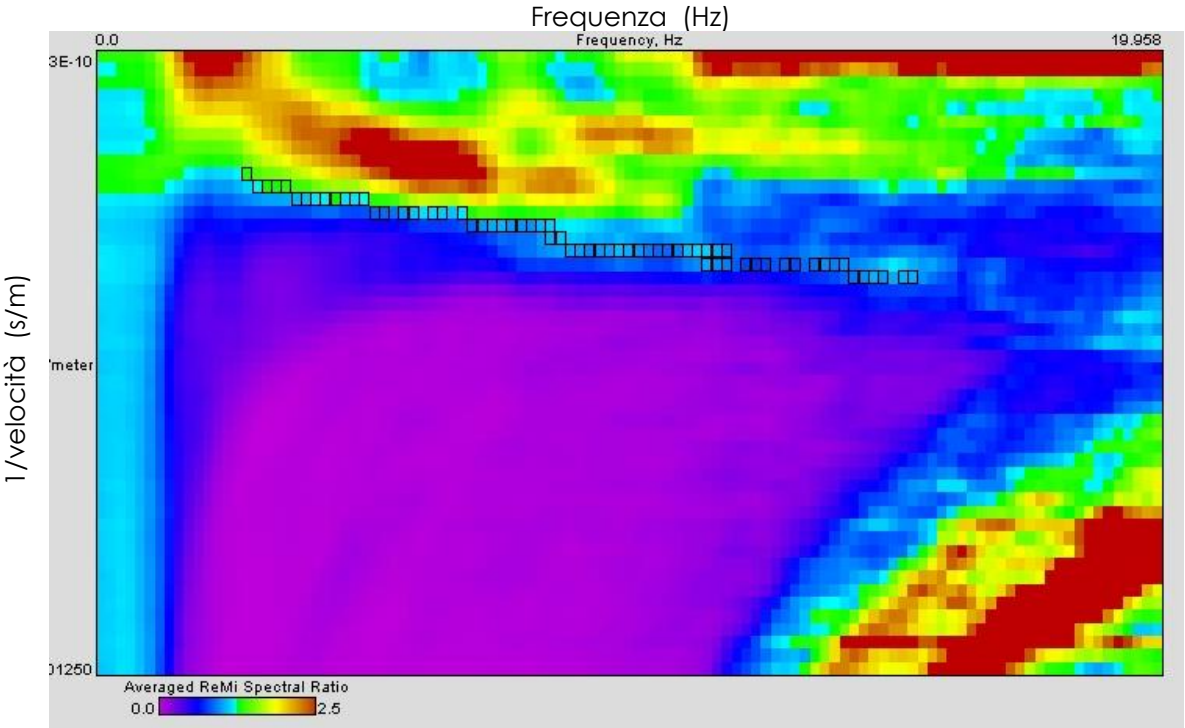


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

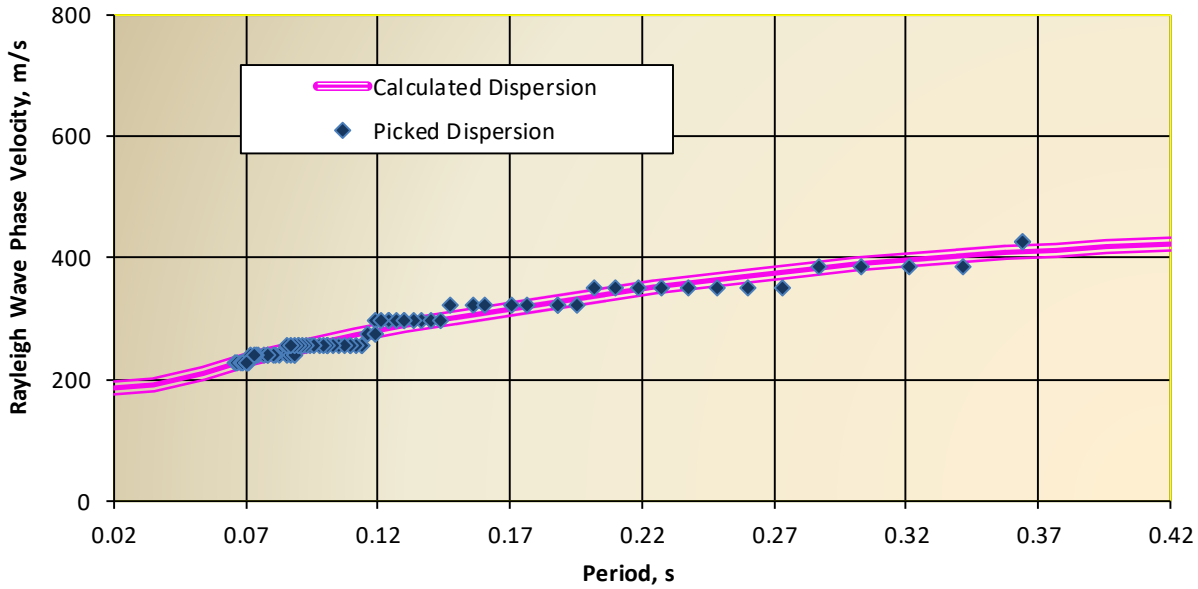


Figura: Diagramma periodo – velocità di fase

Montevarchi 13

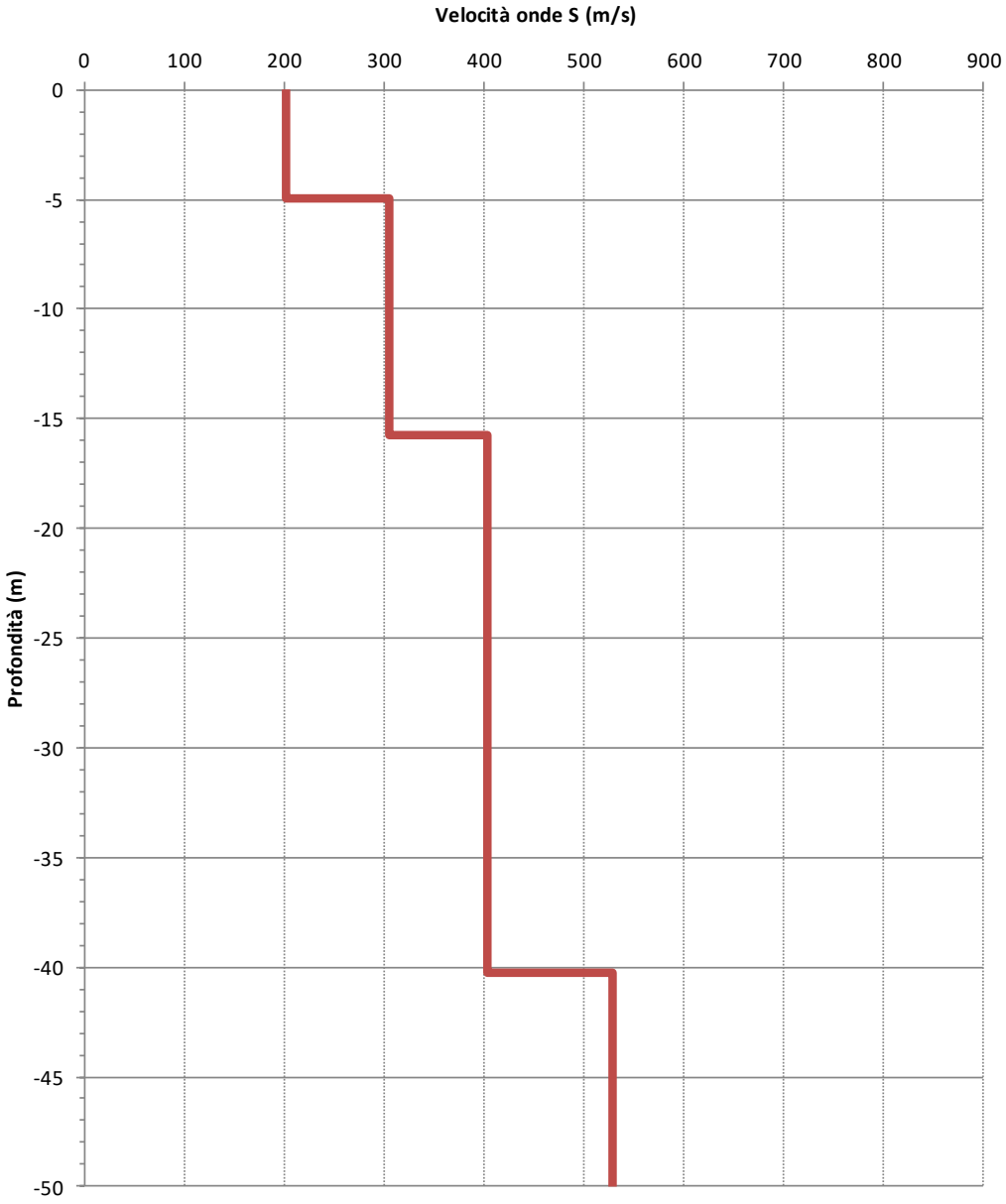


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	4,9	202
4,9	15,8	306
15,8	40,3	404
40,3	50	530

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **316 m/s**.

ESAC 14

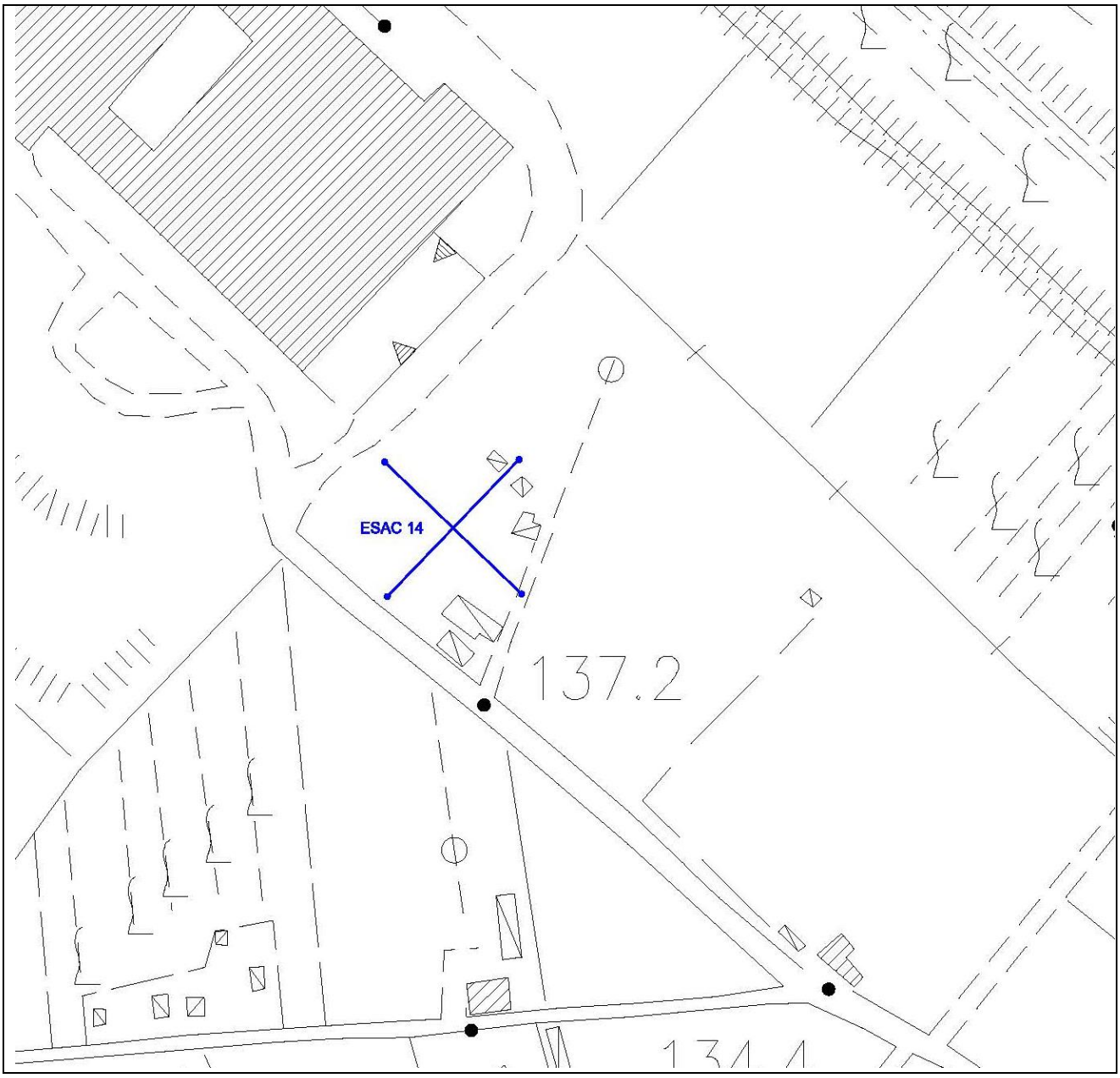


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

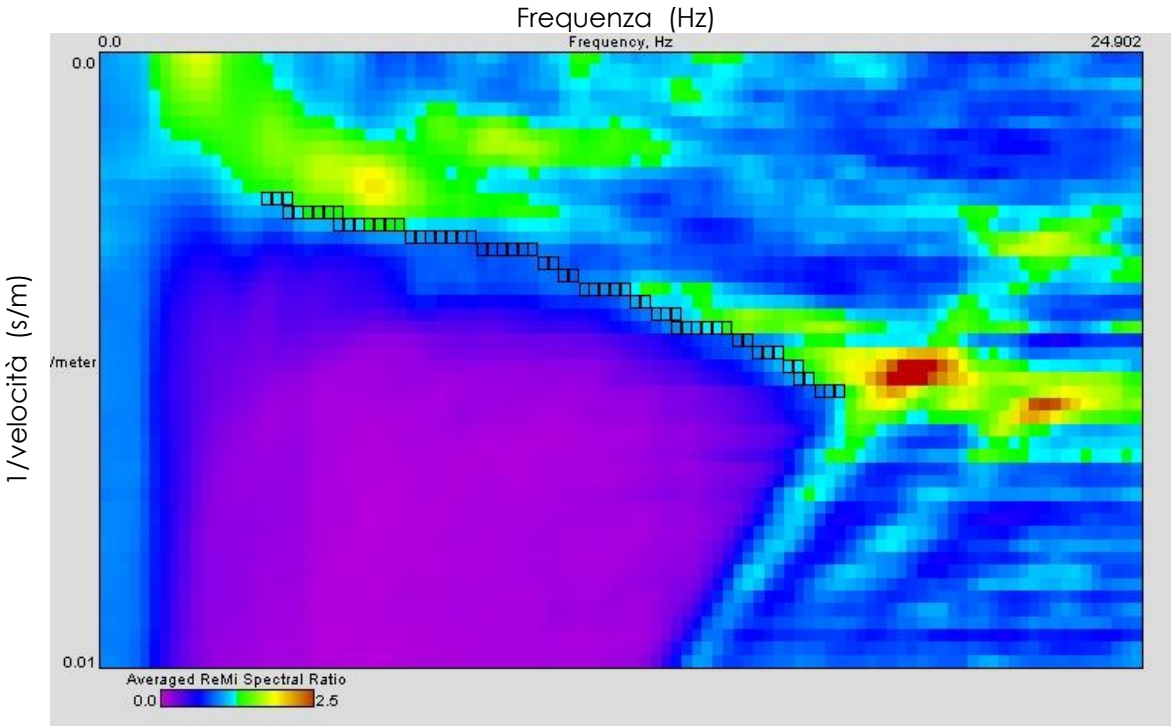


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

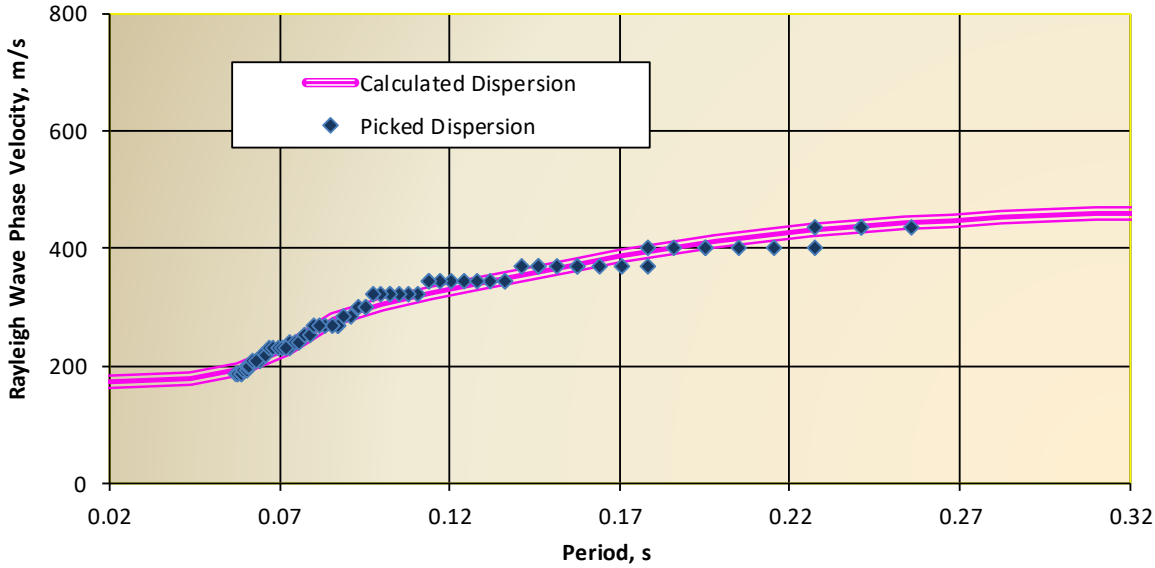


Figura: Diagramma periodo – velocità di fase

Montevarchi 14

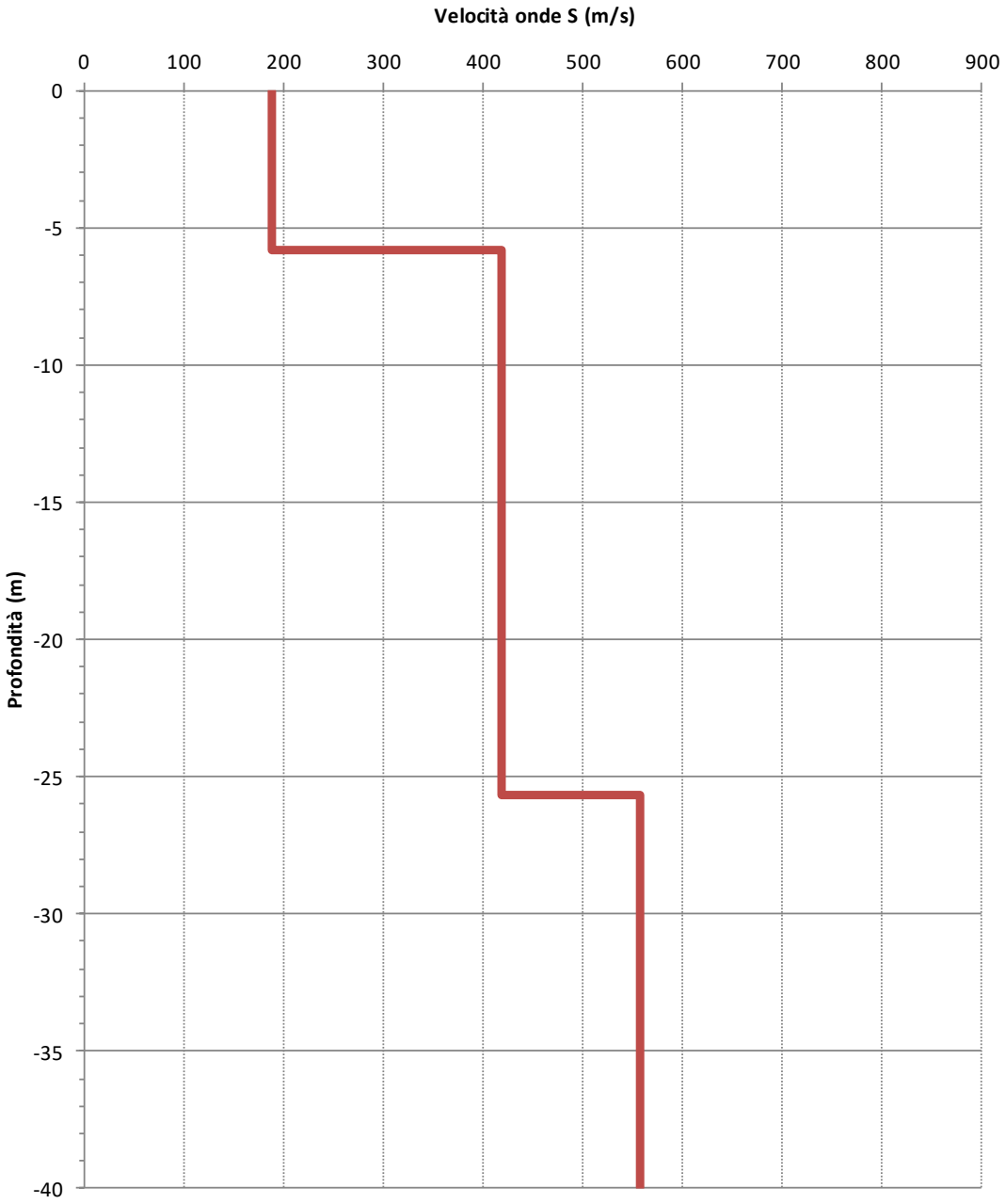


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	5,8	188
5,8	25,7	420
25,7	40	558

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **352 m/s**.

ESAC 15

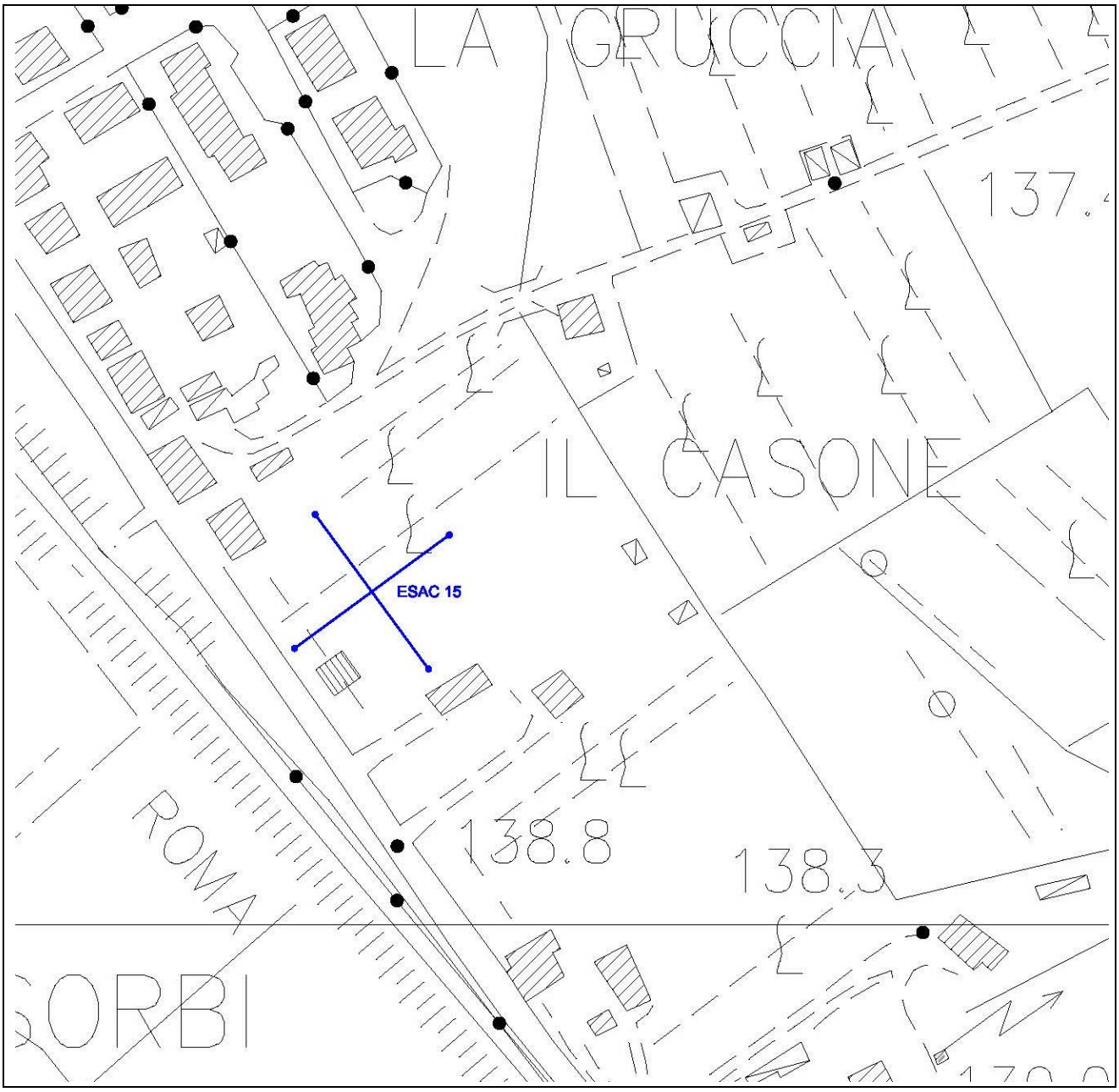


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

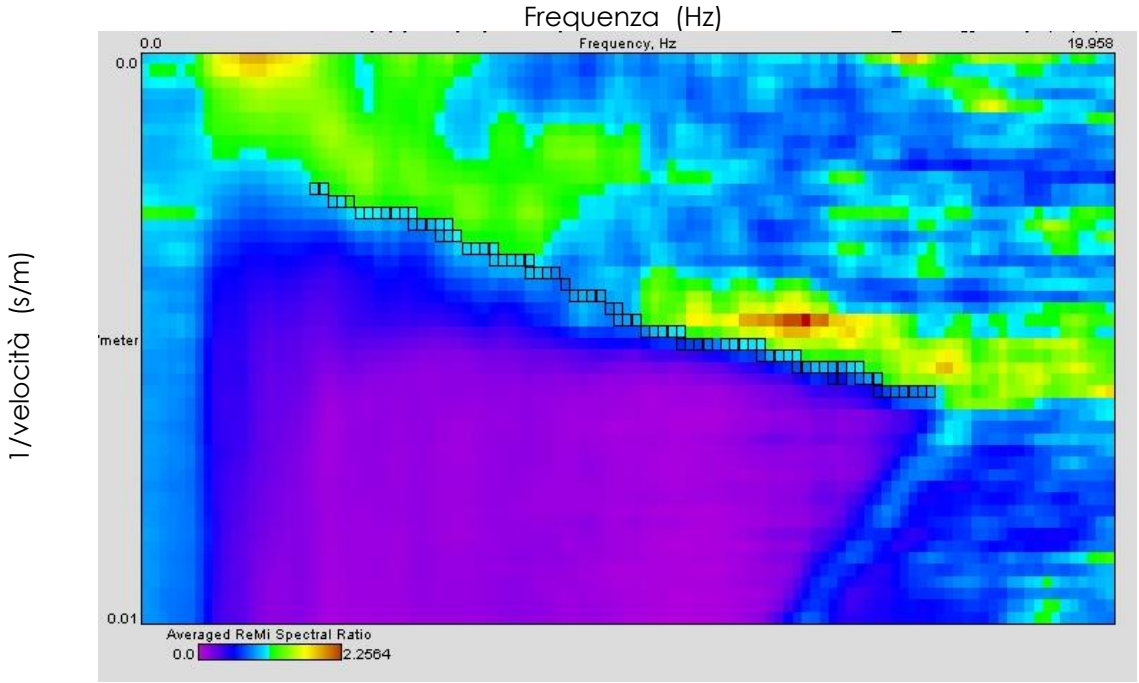


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

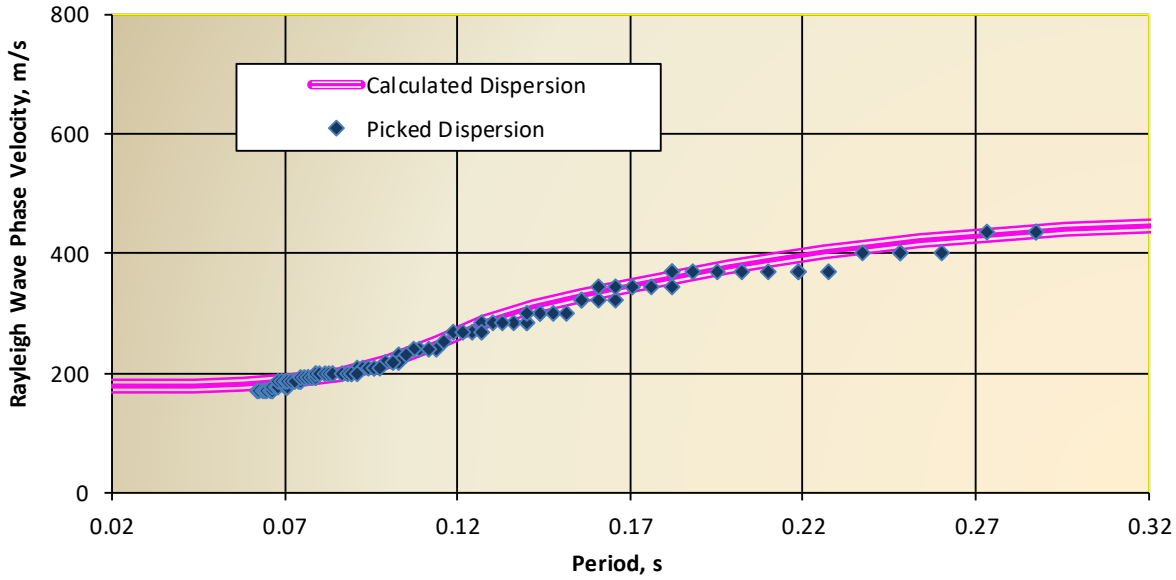


Figura: Diagramma periodo – velocità di fase

Montevarchi 15

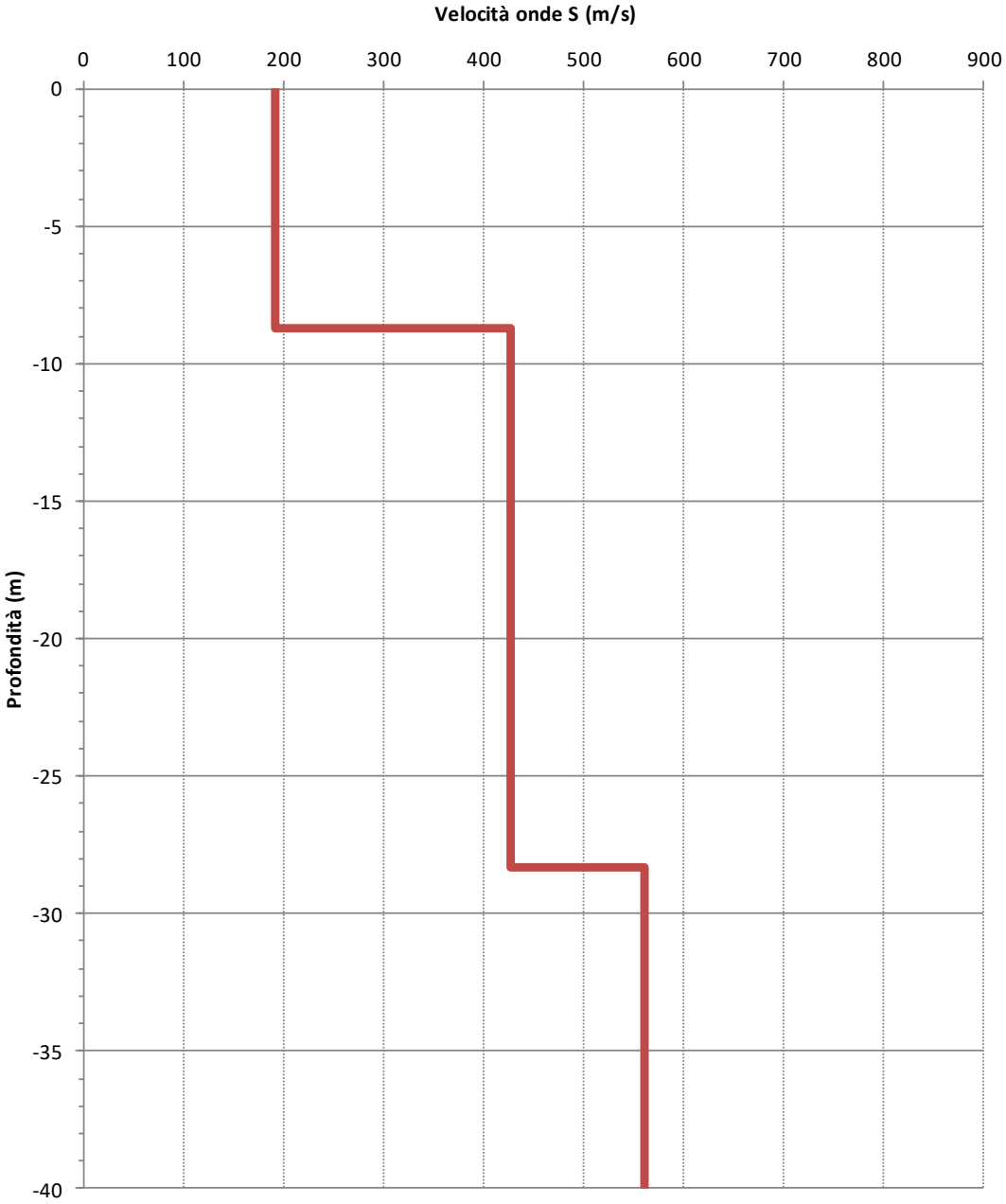


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	**8,7**	**192**
8,7	**28,3**	**428**
28,3	**40**	**562**

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **321 m/s**.

ESAC 16

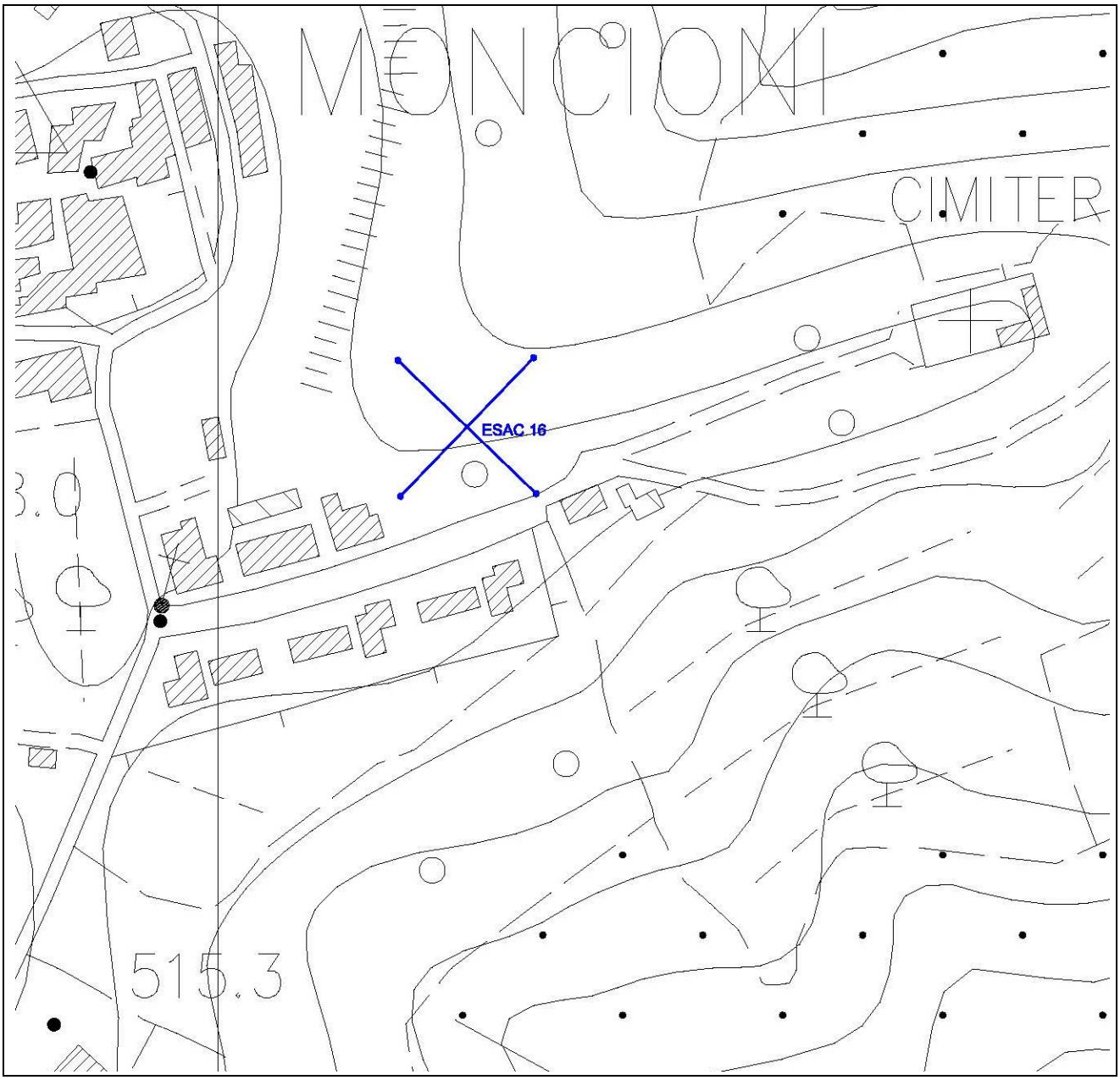


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

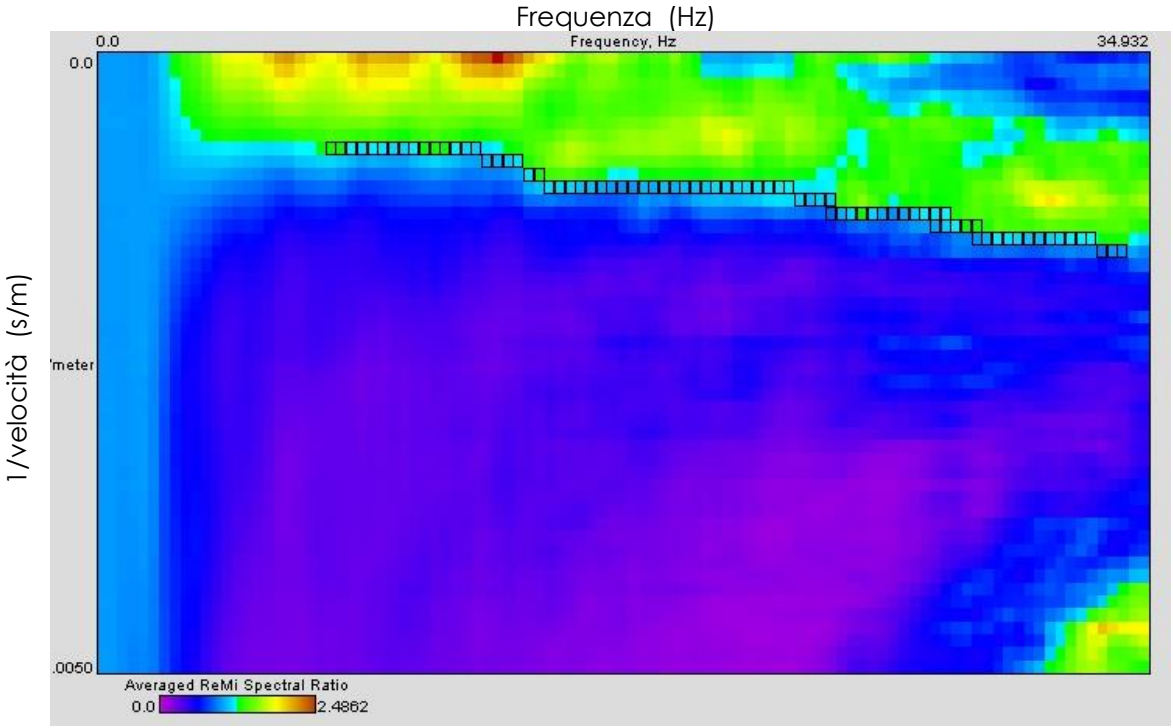


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

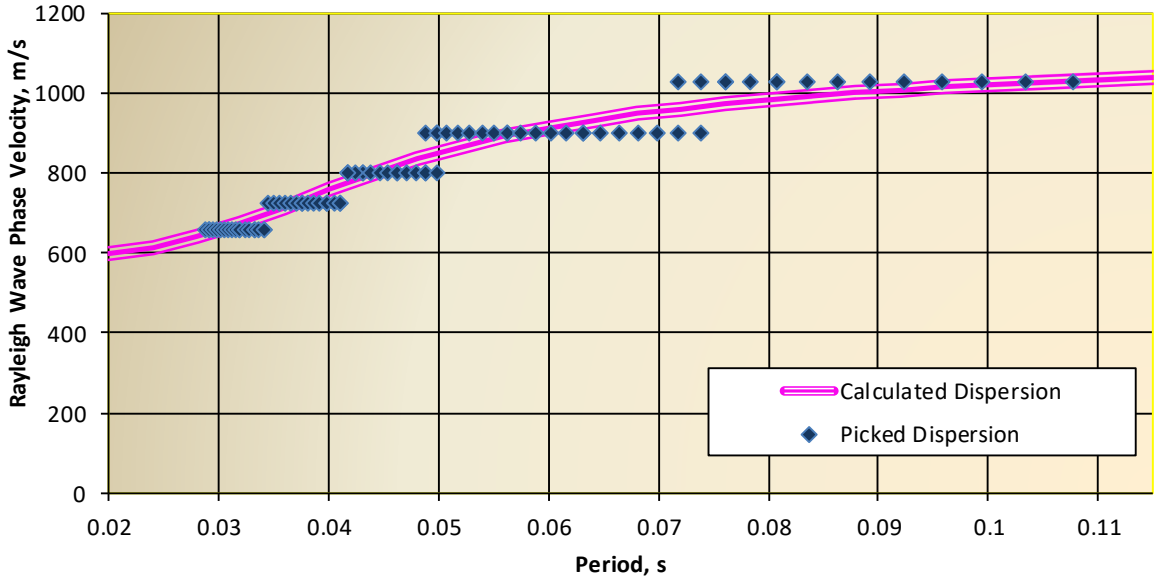


Figura: Diagramma periodo – velocità di fase

16 Montevarchi

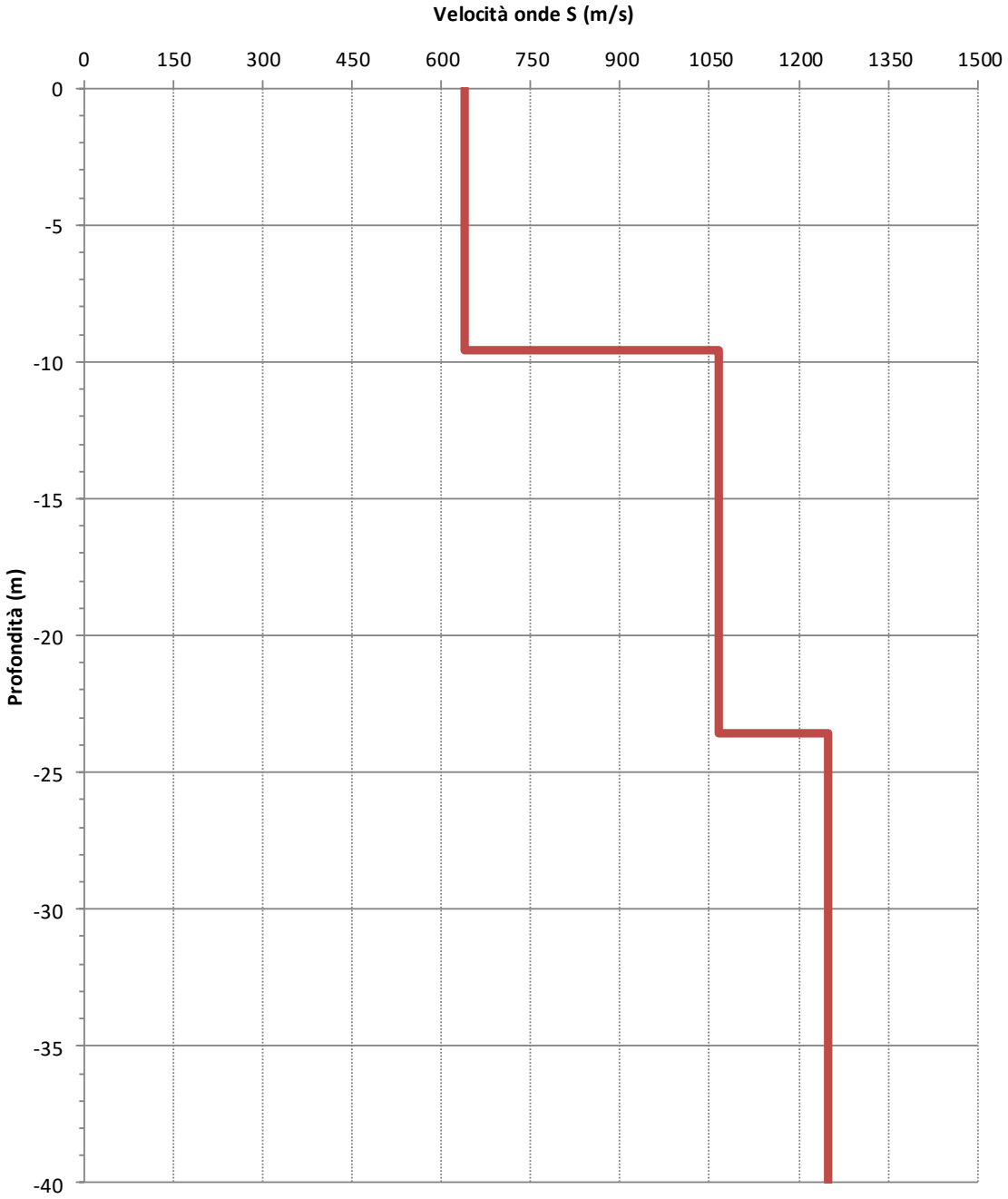


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	9,6	639
9,6	23,6	1066
23,6	40	1249

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **639 m/s**.

ESAC 17

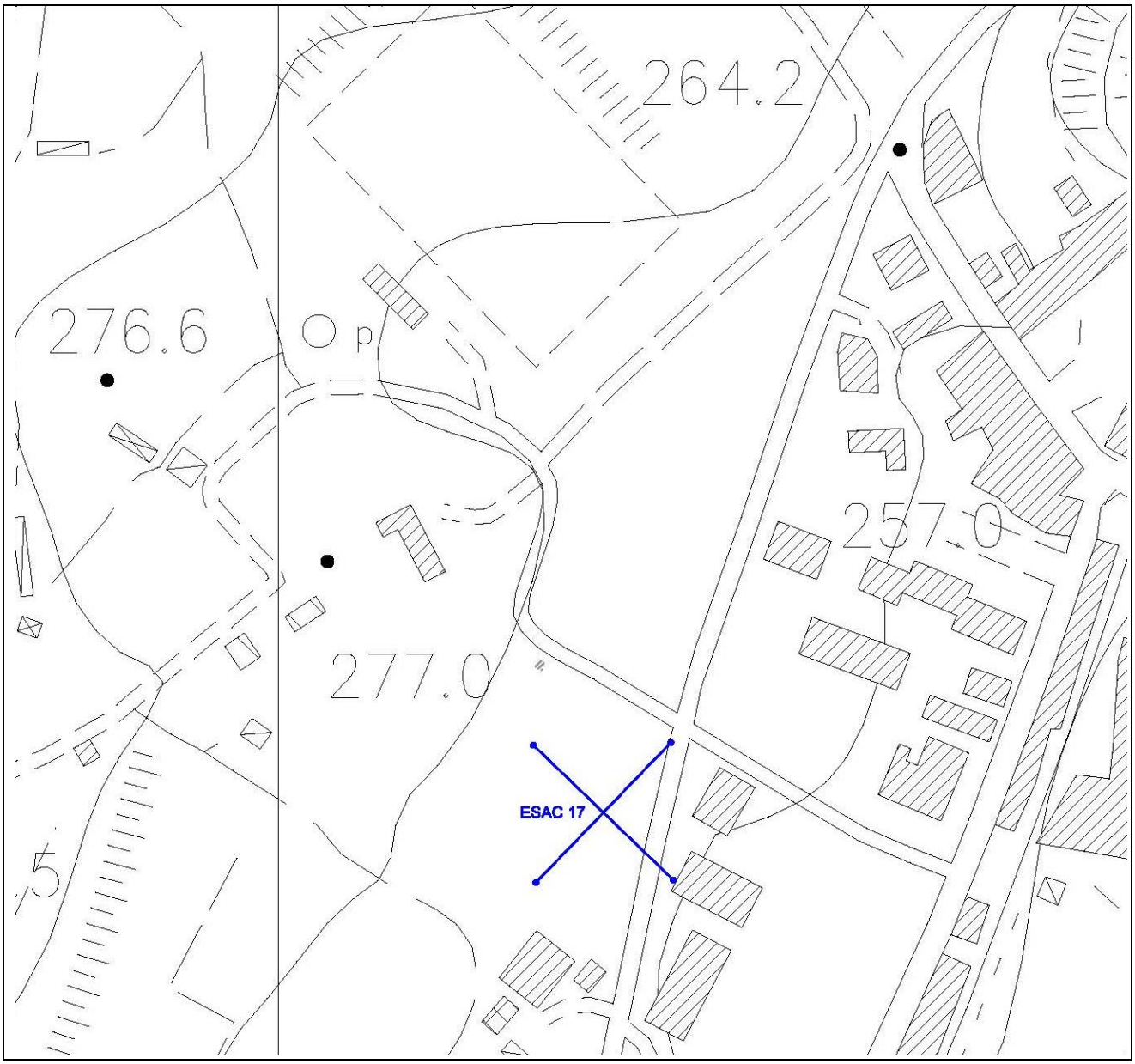


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

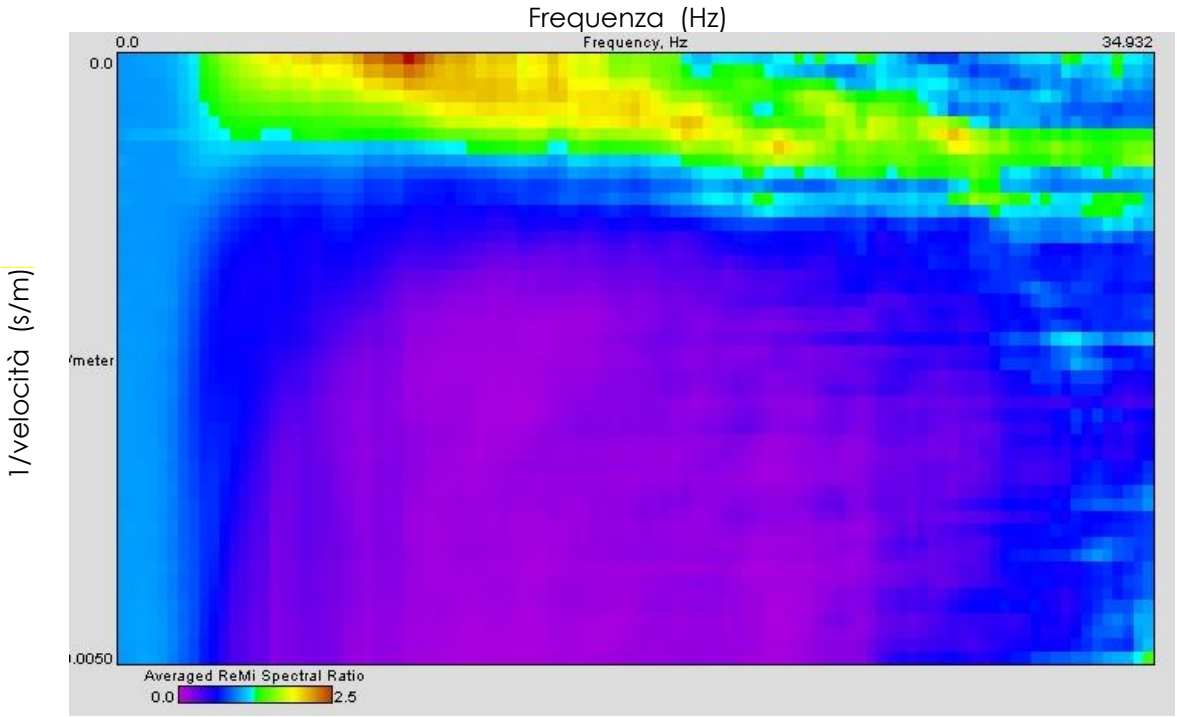


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

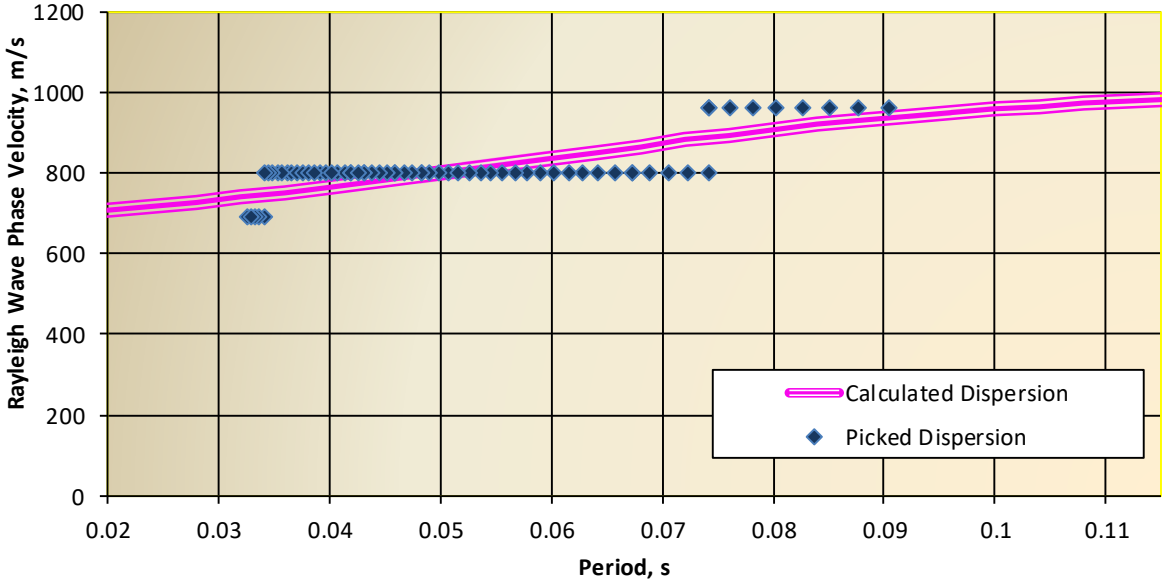


Figura: Diagramma periodo – velocità di fase

Montevarchi 17

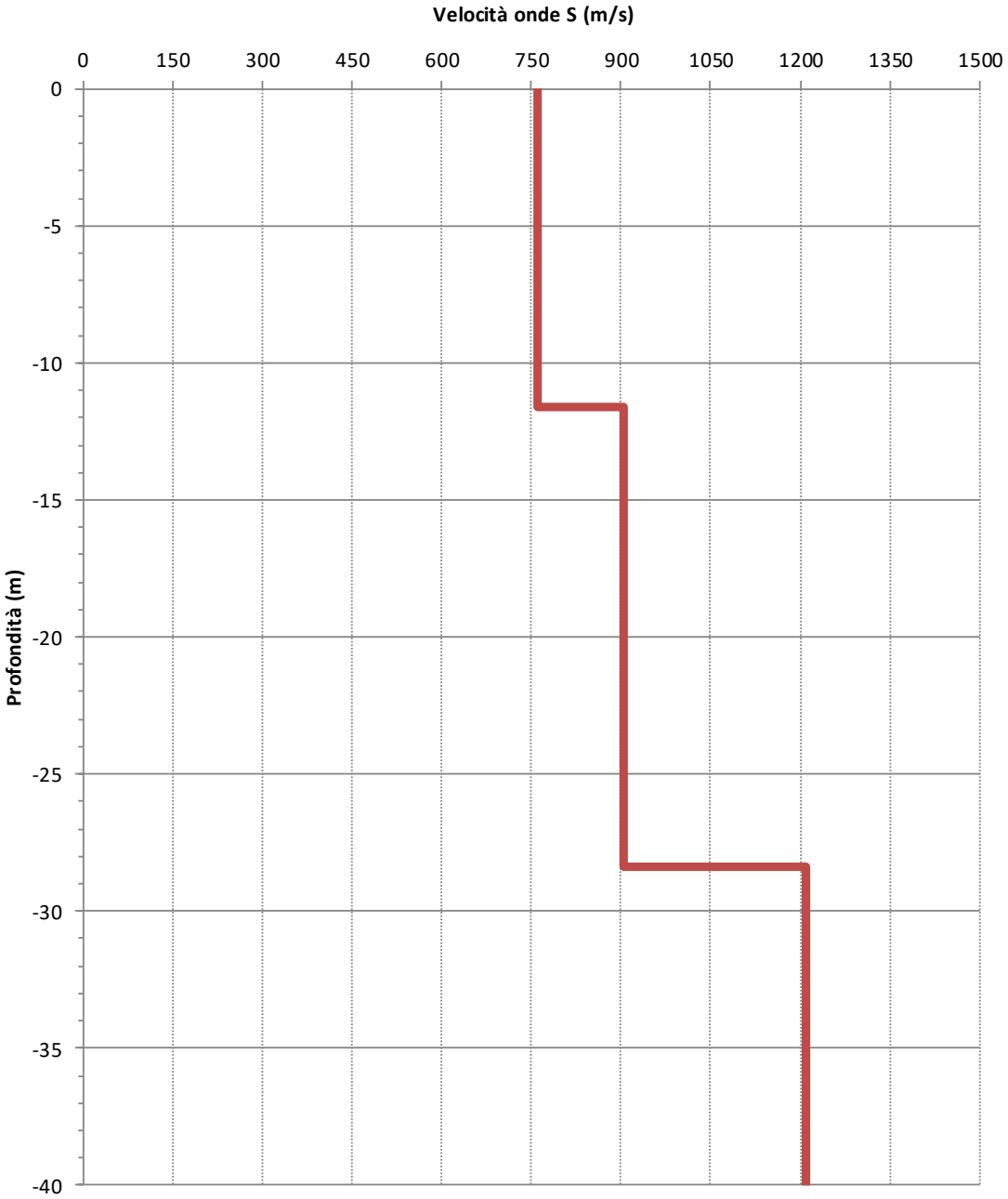


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	11,6	761
11,6	28,4	904
28,4	40	1209

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **761 m/s**.

ESAC 18

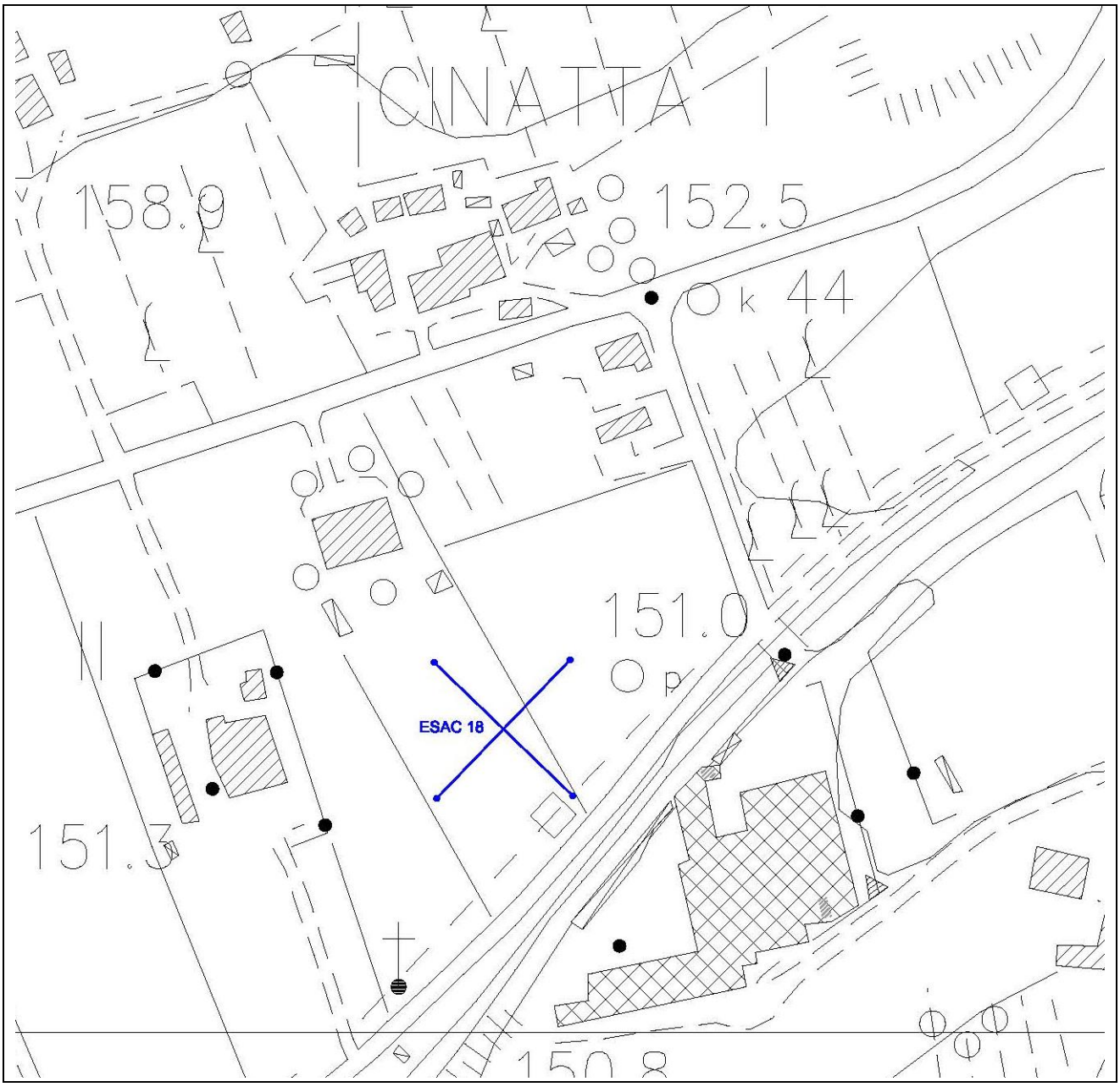


Figura 1.1 – individuazione del sito di studio - scala 1:2.000

Figura 1.2: rilievo sismico

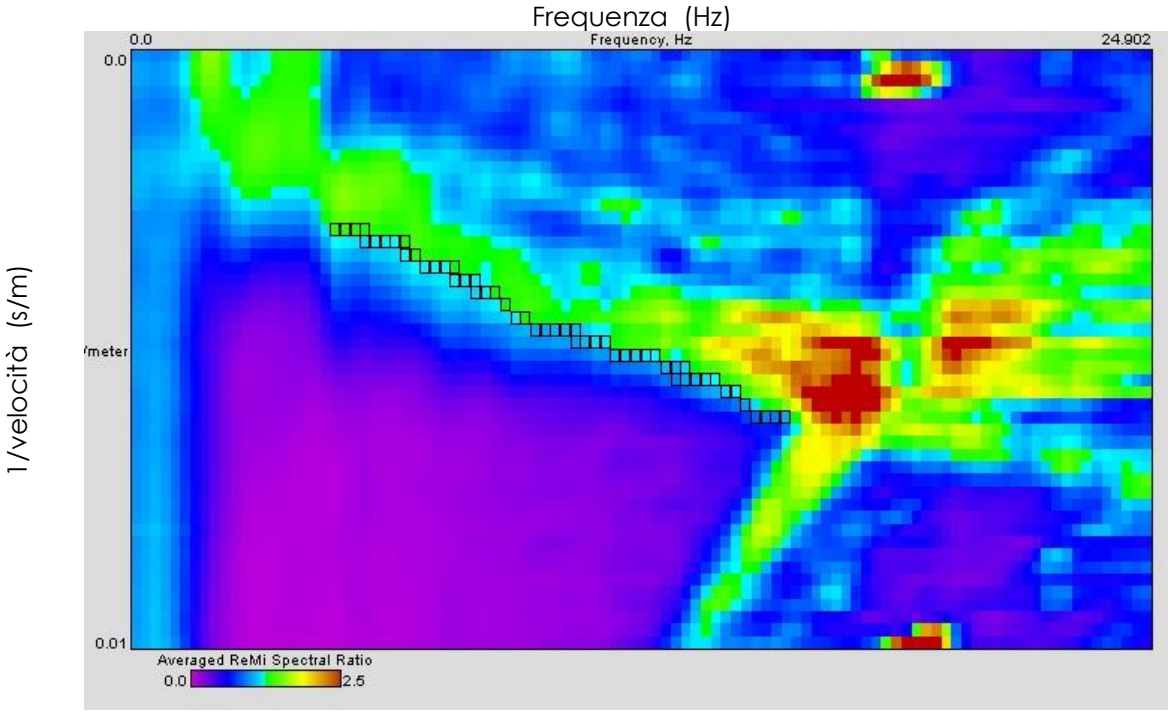


Figura: grafico p-f spettro di velocità con picking della curva di dispersione

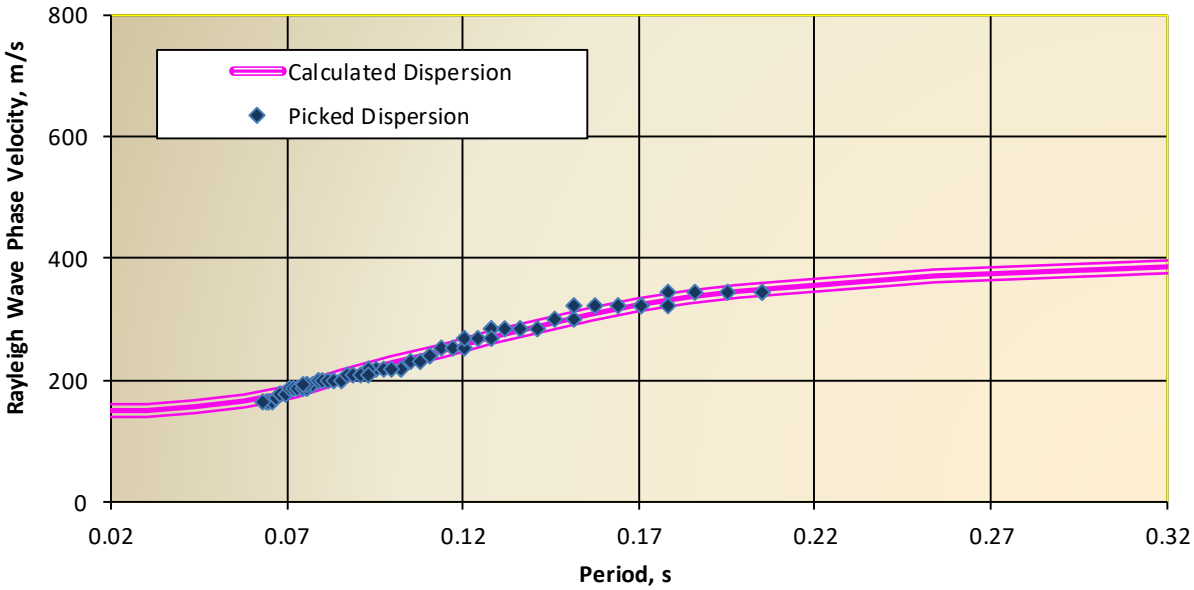


Figura: Diagramma periodo – velocità di fase

Montevarchi 18

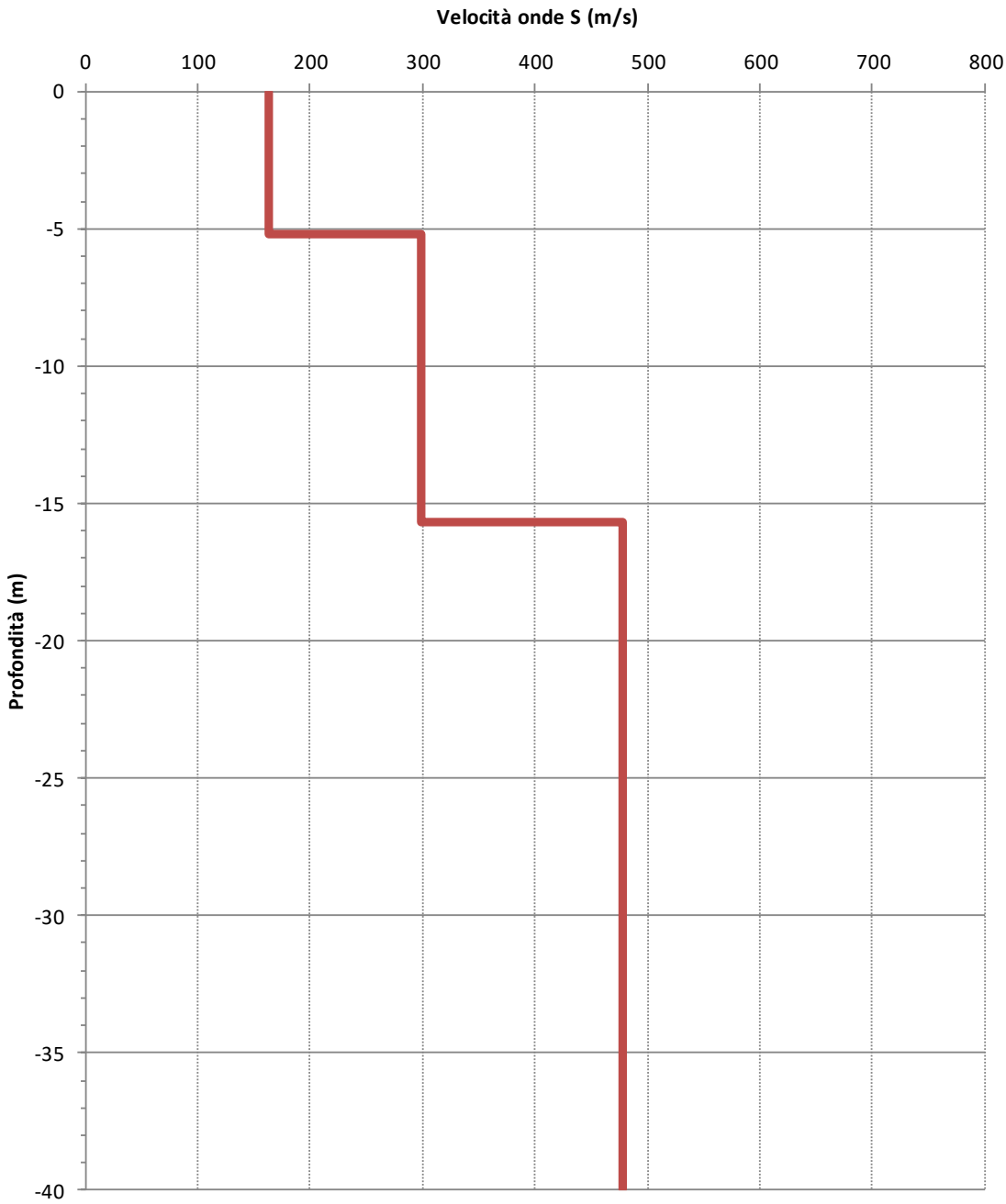


Figura: modello interpretativo

Profondità da P.C (m)		Velocità Onde S (m/s)
0	5,2	164
5,2	15,7	299
15,7	40	478

Per questo terreno il valore di Vseq (calcolato da p.c.) risulta pari a **312 m/s**.