Bright S-Wave Reflections Extensively Distributed Beneath the Backbone Range of the NE Japan Arc (Extended Abstract)

著者	Hori Shuichiro, Umino Norihito, Hasegawa Akira
雑誌名	The science reports of the Tohoku University. Fifth series, Tohoku geophysical journal
巻	36
号	4
ページ	526-530
発行年	2003-05
URL	http://hdl.handle.net/10097/45442

Tôhoku Geophys. Journ. (Sci. Rep. Tôhoku Univ., Ser. 5), Vol. 36, No. 4, pp. 526–530, 2003

Bright S-Wave Reflectors Extensively Distributed Beneath the Backbone Range of the NE Japan Arc (Extended Abstract)

SHUICHIRO HORI, NORIHITO UMINO and AKIRA HASEGAWA

Research Center for Prediction of Earthquakes and Volcanic Eruptions,
Graduate School of Science, Tohoku University,
Sendai 980-8578, Miyagi, Japan

(Received December 20, 2002)

Distinct phases reflected from mid-crustal S-wave reflectors (S×S phases) are often observed in seismograms of nearby shallow earthquakes at stations of the Tohoku University seismic network. Figure 1 shows examples of these reflected phases.

We estimated locations of these S-wave reflectors (bright spots) by using arrival time differences between the reflected and direct waves. The S-wave reflectors are distributed in the whole area of NE Japan, that is, not only beneath volcanic area but also beneath active faults. Depths to the reflectors beneath volcanic areas are shallower than those beneath active faults. Deeper cut-off depth of the reflectors has a positive correlation to that of shallow microearthquakes. It seems that the cut-off depths of both the reflectors and earthquakes are principally governed by the geotherms in the crust (Hasegawa *et al.*, 2000).

Prominent S-wave reflectors are detected beneath the Senya fault which caused 1896 M7.2 Rikuu earthquake (Fig. 3). Some of them are located in the fault plane of the M7.2 earthquake which is estimated from a distribution of recent microearthquakes. Other horizontal reflectors are also detected in the deeper extension of the fault; they may be

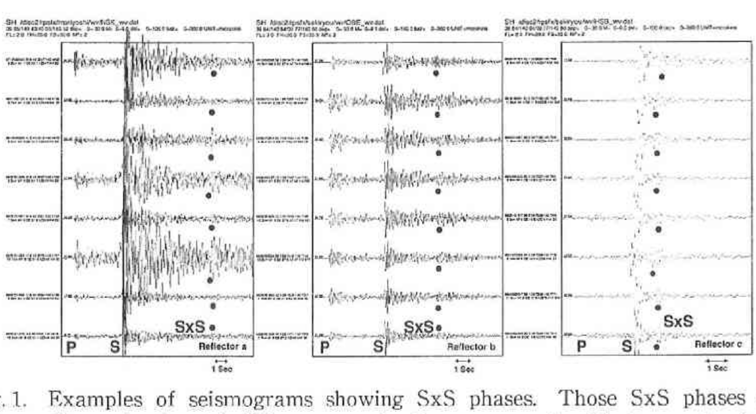

Fig. 1. Examples of seismograms showing SxS phases. Those SxS phases are usually predominant in SH component seismograms. Amplitudes, predominant frequencies and durations of SxS phases vary from place to place. Locations a, b and c are shown in Fig. 3.

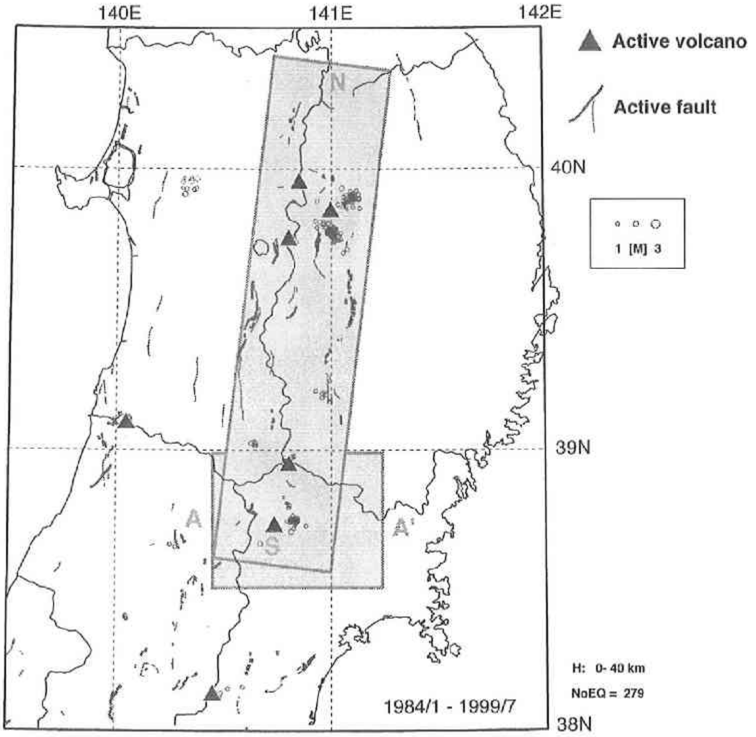

Fig. 2. Locations of vertical cross sections showing depth distribution of the reflectors (NS, AA'). Triangles, circles and short lines denote locations of active volcanoes, low-frequency microearthquakes and active faults, respectively.

a part of detachment fault. In the deeper extension of the fault of 1998 M5.0 Sendai earthquake, many reflectors are also detected (Umino *et al.*, 2002).

S-wave reflectors are also detected beneath the focal area of 1962 M6.5 northern Miyagi earthquake (Fig. 4). It seems that they connect the focal area of M6.5 event with hypocenters of low frequency microearthquakes occurring near the Moho discontinuity.

This close spatial relationship between S-wave reflectors (bright spots), earthquake faults and low frequency microearthquakes suggests that the bright spots are important for better understanding of deep slip process in seismogenic inland fault systems.

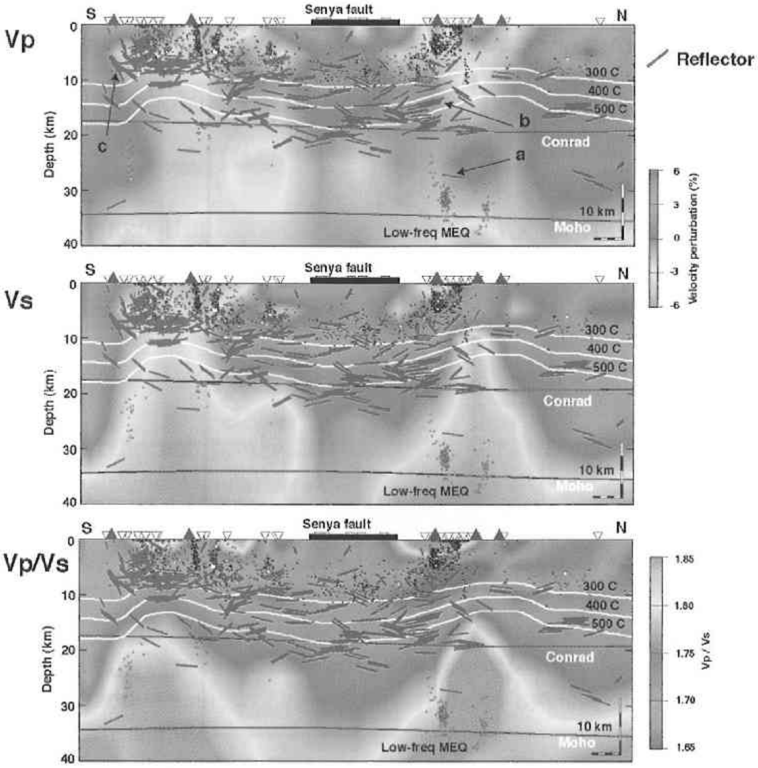

Fig. 3. Vertical cross sections of P and S wave velocity and Vp/Vs ratio along line NS (Nakajima *et al.*, 2001). Vertical exaggeration is 2. Black and red circles denote locations of shallow earthquakes and low frequency microearthquakes, respectively. White lines show the temperature of the crust estimated from P wave velocity perturbations (Hasegawa *et al.*, 2000). Active volcanoes and Senya fault are shown by red triangles and thick line, respectively. Deeper cut-off depths of reflectors and shallow earthquakes become locally shallow beneath the volcanic areas. This leads us to infer that the cut-off depth is prescribed by temperature there and the crustal temperature is considerably inhomogeneous in horizontal direction. Arrows a, b and c in the upper pannel denote locations of reflectors which caused S×S phases shown in the seismograms in Fig. 1

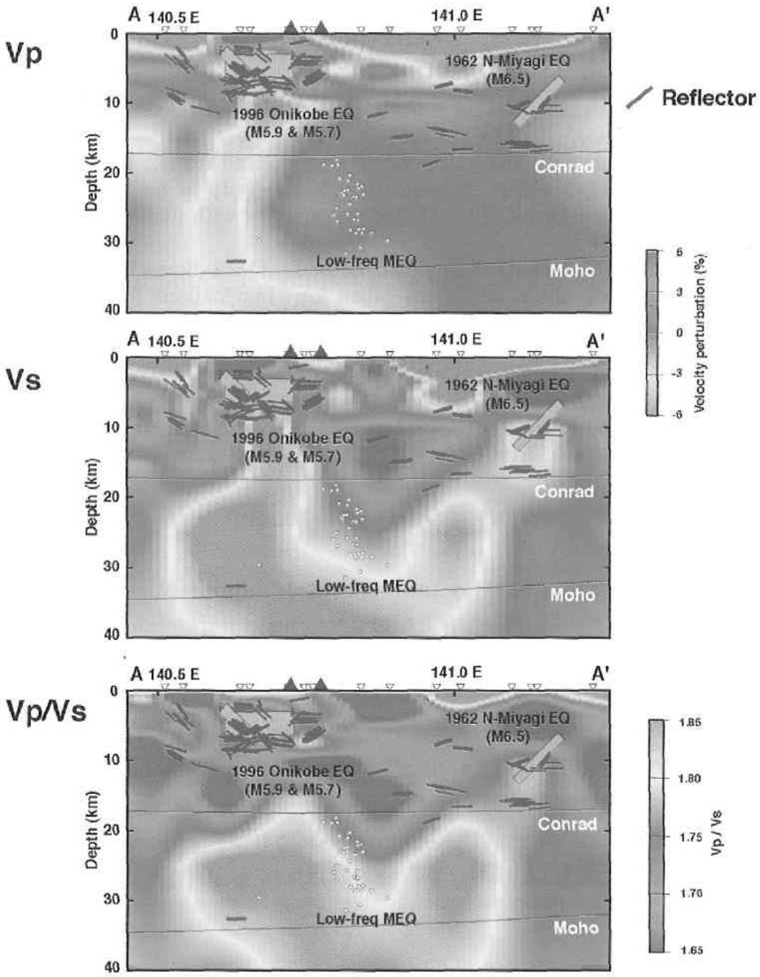

Fig. 4. Vertical cross sections of P and S wave velocity and Vp/Vs ratio along line AA' (Nakajima *et al.*, 2001). Fault planes of 1962 M6.5 N-Miyagi EQ (Kono *et al.*, 1993) and 1996 Onikobe EQ (M5.9 & 5.7) are shown by gray rectangles (Umino *et al.*, 1998). Red circles denote locations of low frequency microearthquakes. S-wave reflectors are distributed just above the high Vp/Vs region which spreads widely beneath the focal areas of 1962 and 1996 events.

References

Hasegawa, A., Yamamoto, A., Umino, N., Miura, S., Horiuchi, S., Zhao, D., Sato, H., 2000 : Seismic activity and deformation process of the overriding plate in the northeastern Japan subduction zone. *Tectonophysics* **319**, 225-239.

Kono, T., Nida, K., Matsumoto, S., Horiuchi, S., Okada, T., Kaihara, K., Hasegawa, A., Hori, S., Umino, N., Suzuki, M., 1993 : Microearthquakes activity in the focal area of the 1962 northern Miyagi earthquake (1962, M6.5) (in Japanese with English abstract), *J. Seismol. Soc. Jpn.,* **46**, 85-93.

Nakajima, J., Matsuzawa, T., Hasegawa, A., Zhao, D., 2001 : Three-dimensional structure of Vp, Vs and Vp/Vs beneath thc northeastern Japan arc : Implications for arc magmatism and Fluids. *J. Geophys. Res.*, **106**, 21843-21857.

Umino, N., Matsuzawa, T., Hori, S., Nakamura, A., Yamamoto, A., Hasegawa, A., Yoshida, T., 1998, 1996 : Onikobe Earthquakes and their relation to crustal structure (in Japanese with English abstract). *J. Seismol. Soc. Jpn.*, **51**, 253-264.

Umino, N., H, Ujikawa and A. Hasegawa, 2002 : Distinct S-wave reflectors (bright spot) detected beneath the Nagamachi-Rifu fault, NE Japan. *Earth Planets Space.*, **54**, 1021-1026.