Three dimensional shallow velocity structure of the Zhuxi ore deposit revealed by an active source and dense array

Yunpeng Zhang[1], Baoshan Wang[1]

[1]Key Laboratory of Seismic Observation and Geophysical Imaging, Institute of Geophysics, China Earthquake Administration, Beijing, China, zhangyp@cea-igp.ac.cn

The Zhuxi Cu-W polymetallic ore deposit is a skarn-type ore deposit located in southern Jingdezhen of the middle Jiangnan belt in Jiangxi Province (Chen et al., 2012). The latest exploration results show that the tungsten reserves of this deposit may exceed 280 Mt (from No. 912 Team). However, there are still many debates about the distribution of ore the body (the center position, the change in the plane, and the extension direction) because there were only a small number of exploration profiles.

To solve the above existing problems, we carried out a project to image the 3D high-resolution shallow velocity structure beneath the Zhuxi deposit. During Nov. - Dec., 2017, we carried out a dense array experiment by multiple geophysical methods in Jiangxi Province (referred to as Jiangxi Experiment hereafter). During this experiment, we totally used four kinds of active sources (Airgun, Vibroseis, CH4 and Hammer), one dense array (178 portable 3-component short period seismometers) and 4 profiles (2311 single-component geophones). The specific excitation sites and station distribution are shown in Figure 1.

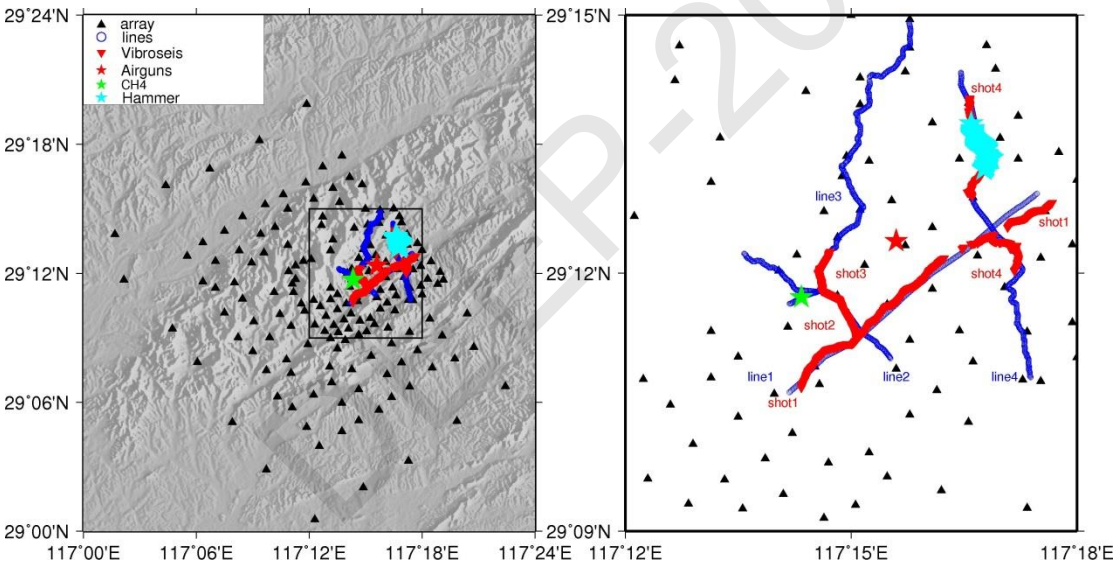

Figure 1. Excitation sites and station distribution for the Jiangxi Experiment. The red, green, blue stars represent the Airgun (215 shots), CH4 (1 shot), and Hammer (44 shots) excitation sites, respectively; Red inverted triangles represent the Vibroseis excitation sites (738 shots); Black triangles and blue circles represent dense array and profiles, respectively;

We manually picked 556609 P-wave arrivals after deleting the bad phases. Three dimensional shallow velocity structures beneath the Zhuxi deposit and surrounding areas were obtained through travel time tomography (Evans et al., 1994). During the inversion, we set a gird spacing of 5 km in horizontally, and 0.05 km at depth. The shallow structures can be well constrained (Figure 2).

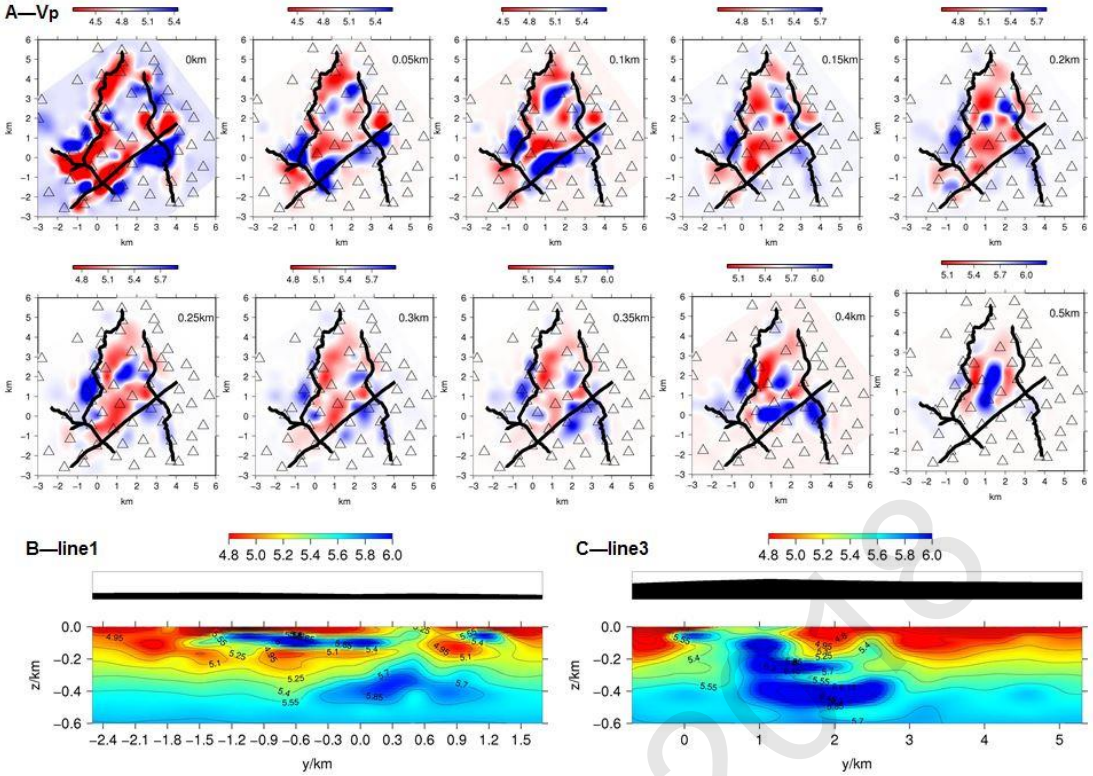

Figure 2. P-wave velocity structures at different depths and two vertical depth sections (line 1 and line 3).

In general, the shallow velocity structures show a clear banded distribution, which are consistent with the surface distribution of the Cu-W polymetallic ore deposit. There are high-velocity anomalies beneath the ore deposit (especially in line 1). The velocity structures beneath the Zhuxi deposit show a significant difference, which corresponds to a fault inclined to the west. The trend of the velocity distribution of line 3 indicates that there may be hidden metallogenic belts in the north and connected with line 1 in the deeper part. These imaging results suppose that active sources can be a promising tool for deep mineral exploration.

References

Chen G H, Wan H Z, Shu L S, Zhang C and Kang C. 2012. An analysis on ore-controlling conditions and geological features of the Cu-W polymetallic ore deposit in the Zhuxi area of Jingdezhen, Jiangxi Province. Acta Petrologica Sinica, 28(12):3901-3914.

Evans J, Eberhart-Phillips D, Thurber C H. 1994. User's manual for SIMULPS12 for imaging Vp and Vp/Vs: A derivative of the 'Thurber' tomographic inversion SIMUL3 for Local Earthquakes and Explosions. Open-File Report, 94-431.

.