Acta Geologica Sinica (English Edition), 2019, 93(supp.2): 178–179

Extraction of Gravity Anomalies in Bozhushan Ore Field, Yunnan Province, SW China: A Comparison of Singular Value Decomposition and Bi-dimensional Empirical Mode Decomposition

GUO Lingfen[1, 2], CHEN Yongqing[1, *] and ZHAO Binbin[3]

[1] *School of the Earth Sciences and Resources, China University of Geosciences, Beijing 100083, China*
[2] *College of Geographic Science, Harbin Normal University, Harbin, Heilongjiang 150025 ,China*
[3] *Sinomine Resource Exploration Co., Ltd. Beijing 100089, China*

Citation: Guo et al., 2019. Extraction of Gravity Anomalies in Bozhushan Ore Field, Yunnan province, SW China: A Comparison of Singular Value Decomposition and Bi-dimensional Empirical Mode Decomposition. *Acta Geologica Sinica* (English Edition), 93(supp.2): 178–179.

Abstract: The Bozhushan ore field is located in the Youjiang Hercynian-Indosinian geosyncline fold belt of the South China Block, is one of the three famous ore concentration areas in the southeastern Yunnan. It is characterized by polymetallic minerals, notably silver, lead, zinc and tungsten. Those minerals are distributed around the Bozhushan granitic complex. The Bainiuchang super-large silver polymetallic deposit occurs on the northwest side of the complex. The recent researches have shown that it has a huge prospecting potential in the deep part of the study area (Cong et al., 2016).

Gravity data play an important role in inferring deep geological structures and buried geological bodies. Like other geophysical fields, the effective utilization of gravity field depends on the establishment of a series of combinational features, such as characterizes morphologies, sizes and depths. These complexities mean that new information decomposition techniques are needed to extraction of ore-forming anomalies information from a large number of geological data(Chen et al., 2017). Over the last ten years, we have done some significant explorations in the application of singular value decomposition (SVD) and bi-dimensional empirical mode decomposition (BEMD) methods in extraction of buried deep mineralization information by decomposing geochemical and gravity data. Based on the previous studies, the SVD and the BEMD are applied to decompose the gravity data surveyed at a scale of 1:50 000 of the Bozhushan polymetallic ore field, Southeastern Yunnan. By comparative study, we get that the images obtained by two methods could accurately reflect the deeply and shallowly concealed geological structures and their spatial relationship with mineralization.

The low-pass filtered images (SVD_1 and Res) decomposed by the BEMD and the SVD are basically the same, which reflect the deeply concealed geological bodies and structures. The negative gravity anomaly reflects the overall distribution of granite bodies in the Bozhushan ore field. Almost all types of deposits around the Bozhushan granite body are located in the negative gravity anomaly area, which reveals the deep metallogenic geological background of the study area. The band-pass filtered images manifest the middle concealed geological structures and geological bodies. Two band-pass filtered images ($BIMF_4$ and $BIMF_3$) were obtained by the BEMD, and one band-pass filtered image (SVD_2) was obtained by the SVD. The gravity image corresponding to $BIMF_4$ shows a concentrated negative gravity anomaly zone, which may reflect the distribution of the medium-depth granites in the Bozhushan area. The scope of the negative gravity anomaly concentration area is larger than that shown by the Res, which indicates that the scale of the medium-depth granite body is enlarged. The images of the $BIMF_3$ and the SVD_2 reveal the middle-shallowly geological structures and geological bodys. The positive gravity anomalies in two images are distributed around the granites with negative gravity anomalies. The positive gravity anomalies may be caused by the faults filled with basic dikes or altered skarn mineralization(Chen et al., 2015), reflecting the middle-shallowly metallogenic geological background of the study area. The high-pass filtered image (SVD_3) decomposed by the SVD may indicate the shallowly geological bodies and structures. The directions of the tectonic lines in the study area are mainly the NW trending and the NE trending. Almost all the deposits are located in the superimposed areas of NW trending and NE trending gravity anomaly, indicating that the mineralization is controlled by the intersection of the two groups of the faults. The intersection of the NW trending and the NE trending structures are favorable areas for the discovery of deposits.

In conclusion, the SVD and the BEMD methods are suitable for extracting gravity anomaly information. The two methods not only objectively depict the relationship between granite body, mineralization and gravity anomaly at different scales from respective mathematical principles, but also provide scientific basis for deep prospecting for the study area.

Key words: singular value decomposition (SVD), bi-dimensional empirical mode decomposition (BEMD), extraction of ore-forming anomaly information, gravity anomaly, Ag-Pb-Zn -W polymetallic deposits, Bozhushan granitic complex

Acknowledgements: This research was jointly funded by the NSFC Program (41672329, 41272365) and the Chinese Research & Development Program for probing into deep Earth

* Corresponding author. E-mail: yqchen@cugb.edu.cn

(2016YFC0600509). We also thank Yunnan Geological Survey for providing original gravity data for this research.

References

Chen, Y.Q., Zhang, L.N., and Zhao, B.B., 2015. Application of singular value decomposition (SVD) in extraction of gravity components indicating the deeply and shallowly buried granitic complex associated with tin polymetallic mineralization in the Gejiu tin ore field, Southwestern China. *Journal of Applied Geophysics*. 123, 63–70.

Chen, Y.Q., Zhang, L.N., and Zhao, B.B., 2017. Application of Bi-dimensional empirical mode decomposition (BEMD) modeling for extracting gravity anomaly indicating the ore-controlling geological architectures and granites in the Gejiu tin-copper polymetallic ore field, southwestern China. *Ore Geology Reviews*, 88,832–840.

Cong, Y., Xiao, KY., Liu, Z.T., and Dong, Q.J., 2016. Geological characteristics and resource potential analysis of the Nanpanjiang-Youjiang Sn-Sb-Mn-Zn-Al-Au metallogenic belt. *Acta Geologica Sinica*, 90(07): 1573–1588 (in Chinese with English abstract).

About the first author

GUO Lingfen, female; born in 1983 in Shijiazhuang, Hebei province; Master; graduated from China University of Geosciences (Beijing); PhD student in China University of Geosciences (Beijing). Lecturer of College of Geographic Science, Harbin Normal University. She is now interested in the study on quantitative identification of ore-forming geo-anomalies. Email: guolingfen1984@163.com; phone: 13624603426.

About the corresponding author

CHEN Yongqing, male, born in 1960 in Suzhou City, Anhui Province; PhD; graduated from Changchun University of Geosciences; Professor of School of the Earth Sciences and Resources, China University of Geosciences (Beijing). He is now interested in the study on quantitative identification of geo-anomalies associated with super-large ore deposits, and development and application of non-linear methods for extraction of ore-forming information at greater depths from the Earth's crust. Email: yqchen@cugb.edu.cn; phone: 13301223310