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## Application of the lead isotopes for hidden mineral deposit prediction of Gongbei Gold deposit, NE Tibet Plateau

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The Maqu - Nanping - Lueyang fault system departs the ancient Yangtze block into the two blocks including the West Qinling fold belt and the Songpan - Ganzi fold belt. Numerous gold deposits are distributed along the fault system. The Gongbei Gold deposit and the Dashui (also named Geerke) Gold deposit of Gansu Province are the most famous two among them. The exploration reserves of Dashui amounted to ultra-large type. Dashui and Gongbei Gold deposit are hosted within stratum of the Triassic - Jurassic carbonate - clastic and conglomerate. The orebody of Gongbei Gold deposit extends ca. 1.5 km in EW striking but its reserve is far less than that of the Dashui. Therefore, the deep characteristics of Gongbei Gold deposit and its metallogenetic relationships to the famous Dashui Gold deposit are most important for prospecting for the Gongbei gold exploration. A lot of practical application of the Pb isotopes for hidden mineral deposit demonstrated it is one of significant ore prediction methods (see the references). In this paper, the lead isotopes are used to the two Gold deposits and to characterize the relationship of source region between them. 73 Pb isotopic samples of Gongbei Gold deposit and 108 Pb isotopic samples of Dashui Gold deposit are obtained. Based on these data and regional geological settings, some conclusions can be drawn as follows: 1) Spatially, these deposits related to the small porphyry and dykes of the Triassic to Cretaceous period. However, the ore lead isotopic characteristics of Gongbei and Dashui Gold deposit are essentially different from these plutons and are characterized by the lateral secondary migration of ore-forming fluids. Although there are significant differences between Dashui and Gongbei at ore-bearing strata in the times and lithology, the available data of  $^{206}\text{Pb}/^{204}\text{Pb}$ - $^{207}\text{Pb}/^{204}\text{Pb}$  of them (Fig. 1a) showed the same trend of variation. 2) The element contents of As (150-

730 ppm) and Sb (41-240 ppm) are relatively high in ore of Gongbei, while Cu, Pb content is less than As and Sb, which shows that it is the low-temperature hydrothermal mineralization at the leading edge of hydrothermal process. On  $^{206}\text{Pb}/^{204}\text{Pb}$ - $^{208}\text{Pb}/^{204}\text{Pb}$  correlation diagram (Fig. 1b), the changes of the  $^{208}\text{Pb}/^{204}\text{Pb}$  ratios of the deposits are relatively small (in the range of 38.5-39.0), indicating that they belong to shallow epithermal

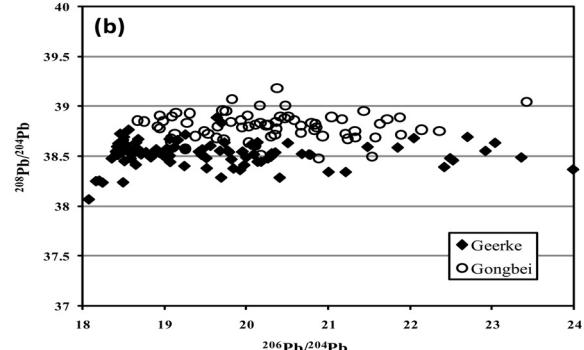
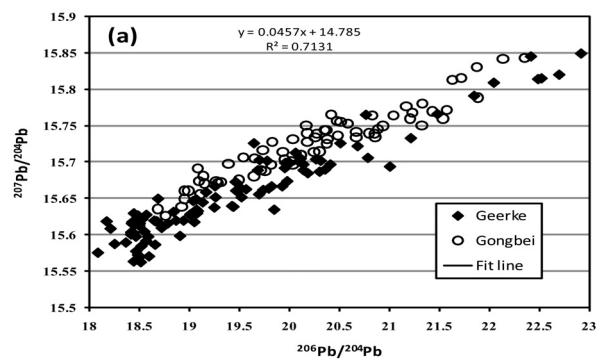


Fig. 1 The diagrams of  $^{206}\text{Pb}/^{204}\text{Pb}$ - $^{207}\text{Pb}/^{204}\text{Pb}$  (a) and  $^{206}\text{Pb}/^{204}\text{Pb}$ - $^{208}\text{Pb}/^{204}\text{Pb}$  (b) for Pb isotopic relationships between the Gongbei and Dasui gold deposits

mineralization system. These Pb isotopic characteristics indicate that the same hydrothermal system are responsible for the two deposits, the mineralization are at

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the same time with secondary migration mineralization and ore materials are probably derived from the lower part of the Early Palaeozoic rocks. 3) According to the tectonic setting, regional mantle Pb isotopic compositions have the affinity to the northern margin of Yangtze block and have no any relationship to the Qilian Mountains. Therefore the mantle V2 value (topological projection of Pb isotopes in tri-dimension space) of the northern edge of the Yangtze region are regarded as a standard to calculate the hidden coefficient and yielded the result of ca. 36.5, and the discrepancy of ca. 10 exists while comparing this V2 value with regional crust average value. This is also consistent with the general crust - mantle variation. 4) The lead isotopic V value of exploration line No. 156~160 for Gongbei Gold deposit have significant high positive anomaly in the cross-section and is obvious different from Dashui Gold deposit. The V2 vs. H (altitude) correlation calculations show that the ore - forming cut-off depth is up to 2900 m, deep prospecting exploration depth is of 600 meters or more. The hidden coefficient of three exploration line are amounted to an average of  $33.3 \pm 2.2$ , the average enrichment factor are amounted to  $4.0 \pm 50.27$ . Based on the current gold reserves of 5 tones in the ore district, the estimated reserve of the Gongbei Gold deposit is up to  $166 \pm 11$  tons, the average grade of the deep have roughly revealed up to about 4 times to the average grade. Therefore, the potential of Gongbei Gold deposit is greater than Dashui Gold deposit. 5) So it is believed that the Gongbei Gold deposit and Dashui Gold deposit are the same deposit in the depth and exploration work should be concerned on the transition zone between the two deposits.

**Key words:** Gongbei Gold deposit, Dashui Gold deposit, hidden mineral deposit, Pb isotopes, Gansu

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