Ore-Forming Fluids of Au-Hg Deposits

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Despite the similarity of mineral composition (gold, pyrite, arsenopyrite, cinnabar, realgar, stibnite, Tl-minerals, barite, etc.) and geochemical features of ores (Au, Hg, As, Sb, Tl, Ba, etc.), the gold-mercury deposits are similar formations which formed by different ore-forming systems: volcanogenic-hydrothermal and plutonogenic-hydrothermal.

The fluid inclusion study carried out at 22 gold-mercury deposits of Russia and Mongolia showed that all these deposits formed at low temperatures (<280°C) and on the whole they are close to the Sb-Hg deposits, but fluids of volcanogenic-hydrothermal deposits are characterise by low salinity (0.5 – 10 wt. %) and chloride or chloride-bicarbonate-sodium composition with low-dense (N, CO_2, $\pm CH_4$) gas phase. The lower temperature deposits (<150-170°C) have fluids of lower salinity (0.5-7 wt. %). For a number of higher temperature deposits heterogenization of fluids with separation of gas phases (H_2O>>CO_2>N_2) is observed. Plutonogenic-hydrothermal deposits are distinquished by wider variations in salinity of ore-forming fluids (0.2-25 wt. %), more complex composition (NaCl, $CaCl_2$, $FeCl_2$, KCl etc.), and essentially carbon dioxide gas phase (CO_2> N_2 > H_2O). In fluid inclusions of these deposits the liquid carbon dioxide occurs, testifying to higher pressure of hydrothermal fluids (up to 510 bar).

However gold-mercury deposits significantly differ from the other types of gold deposits such as gold-sulfide-quartz, gold-silver, gold-antimony which are higher temperature formations. The specific feature of fluid composition of Au-Hg deposits is mainly determined by the participation of various types of exogenous waters (meteoric water, oil water, chloride brines, etc.). This is manifested in the specifics of their composition for particular regions, distinguished by paleohydrogeological environment of formation of gold-mercury deposits under the near-surface condition. During formation of Au-Hg mineralization one of the main factors responsible for the deposition of Au and Hg is a process of heterogenization of ore – forming fluids and decrease of temperature and pressure.

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Sr-Pb isotopic evidence for plume-ridge interaction along the Central Indian Ridge

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The Central Indian Ridge (CIR) between 18° and 20°S shows characteristics of hotspot-ridge interaction such as increased crustal thickness and the presence of off axis ridges (Rodrigues, Three Magis and Gasitao ridges [1]). We present triple spike Pb isotope [2] and Sr isotope data for on and off-axis MORB samples from this region to determine whether such interaction is taking place.

The isotope data show the existence of two distinct groups, consistent with those defined from major and trace elements variations [3]. The first one, composed by MORB produced on the CIR-axis, is characterized by lower Sr and Pb isotope ratios ($^{206}Pb/^{204}Pb$ = 18.304-18.703; $^{207}Pb/^{204}Pb$ = 15.502-15.571; $^{208}Pb/^{204}Pb$ = 38.182-38.737 and $^{87}Sr/^{86}Sr$ = 0.7031-0.7038) than the Gasitao group ($^{206}Pb/^{204}Pb$ = 18.583-18.792; $^{206}Pb/^{204}Pb$ = 15.551-15.579; $^{208}Pb/^{204}Pb$ = 38.532-38.730 and $^{87}Sr/^{86}Sr$=0.7035-0.7039). These two groups form two distinct arrays in $^{207}Pb/^{204}Pb$-$^{206}Pb/^{204}Pb$ space with different slopes. The Gasitao group data are displaced toward higher Pb and Sr isotope ratios, and trend towards the field of the Réunion hotspot [4]. There is also a North-South decrease in Pb isotope ratios along the CIR axis, similar to that found using trace elements [3].

We interpret the along-axis variations as reflecting the influence of the fossil Réunion hotspot track, which is cut by the CIR at around 15°S. At this latitude, both Pb and Sr isotope ratios of CIR MORB display a clear increase, consistent with such an interpretation. The Gasitao group can be explained in terms of mixing between a CIR component and a present-day Réunion plume component. Despite the close spacing of the samples, there are significant isotopic differences between the two groups, suggesting the presence of a boundary between two different mantle domains.

References

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