3.6.P06

Metal sources in sea-floor hydrothermal systems at Mid-Atlantic Ridge and back-arc setting (Pacific): Pb isotope constraints

I. V. CHERNYSHEV, N. S. BORTNIKOV
AND V. N. GOLUBEV

IGEM, Russian Academy of Sciences, Moscow, Russia

A comparative study of the Pb isotope composition in sulfides minerals from modern seafloor sulfide edifices was carried out to understand peculirities of hydrothermal fluids circulated in different geodynamic environments. The edifices studied located on the slow-spreading Mid-Atlantic Ridge (the Logachev-1, Rainbow, Broken Spur active hydrothermal fields and relict Mir zone (TAG) and in the Manus (Vienna Wood), Lau basins (southwestern Pacific) representing the back arc At the slow-spreading Mid-Atlantic Ridge, Mir zone (TAG), Broken Spur associate to neovolcanic basaltic dome are related with magmatic cycle of a rift development. Logatchev-1, Rainbow fields associated with serpentinite protrusions form during a tectonic cycle.

The Pb isotope study revealed that the ratios of $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, and $^{208}Pb/^{204}Pb$ in sulfides at Mid-Atlantic Ridge varies as follows: 18.30–18.36, 15.46-15.53, 37.75-37.95 (Mir zone), 18.16-18.24, 15.45-15.48, 37.72-37.78 (Broken Spur), 18.71-18.78, 15.49-15.54, 38.28-38.42 (Rainbow), and 18.90-19.28, 15.54-15.58, 38.56-38.96 (Logatchev-1), respectively. These values lie within the field of Pb isotope ratios reported for MORB, but minerals from serpentinite-related edifices are richer in radiogenic Pb. An examination of 15 samples of sulfide material from the "Vienna Wood" hydrothermal field revealed the variations in ratios of $^{206}Pb/^{204}Pb$ from 18,27 to 18.35, $^{207}Pb/^{204}Pb$ from 15.46 to 15.54, $^{208}Pb/^{204}Pb$ from 37.94 to 38.23. These data points lie on the stright line beginnig at the line connecting DMM and EM II reservoirs. Although these points fall in the field of Pb isotopic ratio ascribed to MOR basalts, these results can be interpreted as a mixture of lead derived from basalts and pelagic sediments. Four samples from the Central Lau hydrothermal field gave nearly identical values of $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, and $^{208}Pb/^{204}Pb$ ranging from 18.15 to 18.17, from 15,49 to 15.51, and from 37.98 to 38.08, respectively. Previous study of Pb isotope compositions of sulfides gave the $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, and $^{208}Pb/^{204}Pb$ ratios ranging from 18.59 to 18.66, from 15.57 to 15.62, and from 38.60 to 38.78, respectively. A significant contribution of radiogenic lead indicate an involvement of lead in this hydrothemal system derived from pelagic sediments. Thus, this study indicates a participations of lead derived from pelagic sediments in hydrothermal systems located at sediment-starved spreding ridges and diversity of metal sources in the modern hydrothermal systems.

3.6.P07

Melt inclusions in Hetai lode gold deposit, southeast China: Implication to gold mineralization

W. ZHAI, Z. LI AND Y. WEN

Department of Earth Sciences, Sun Yat-sen University, Guangzhou, China (eeszw@zsu.edu.cn)

The Hetai lode gold deposit in southeast China is hosted in the Hetai ductile shear zone. By using microscope, microthermometry, Raman microspcetrometry and electron probe X-ray micro-analyzer, three type of fluid inclusions have been identified in quartz in sulfide-rich gold –bearing quartz veins: polypase melt inclusions dominated by hydrous crystallized silicate melt ± hydrous silicate glass ± sulfide melt $\pm$ CO_2-H_2O volatile fluid or crystallized carbonatite melt ± sulfide melt $\pm$ CO_2-H_2O volatile fluid inclusions (Fig. 1 A, B); liquid CO_2-CH_4 ± liquid aqueous inclusions; and aqueous inclusions. The compositions of polypase melt inclusions are SiO_2-rich with SiO_2 71.09~85.52%, Al_2O_3 0.10~1.36%, CaO 0.36~6.98%, MgO+FeO 1.26~12.32%, K_2O+Na_2O 0.17~2.68%, or K_2O-rich with K_2O 6.62~10.63%, Si_2O 49.17~54.72%, Al_2O_3 28.51~34.01%, MgO+FeO 2.70~4.09%. sulfides in melt inclusions are crystallized pyrite, pyrrhotite, or chalopyrite corresponding to minerals in ore. The liquid CO_2-CH_4 inclusions are composed of mol 35~77% CO_2 and mol 23~65% CH_4 by Raman microspectrometry, the melting temperature of solid CO_2-CH_4 ($T_{mCO2+CH4}$) is -60.1~-67.0℃, the homogenization temperature ($T_{h\ CO2+CH4}$) is −42~12.7℃. The homogenization temperature (T_h) of liquid-vapor aqueous inclusions is 200~360℃, salinity is wt3.7~10.8% NaCl, the density is 0.73~0.95g/cm^3.

The ore fluid is not water solution, but SiO_2-rich silicate melt which is enrichment of volatile CO_2-H_2O-CH_4 fluid and contains carbonatite melt and sulfide melt. Gold and Sulfides may migrate in the form of melt in ore fluid. Gold mineralization is the result of immiscibility among volatile CO_2-H_2O-CH_4 fluid, SiO_2-rich silicate melt, carbonatite melt, and sulfide melt. The metallogenetic temperature is higher than the homogenization temperature of liquid-vapor aqueous inclusions, the metallogenetic pressure is 2~3Kbar (a depth of 7.0~10.0km).
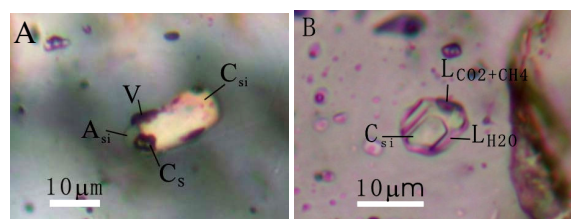

Fig. 1. Polypase melt inclusions in host mineral quartz. C_{si}—hydrous crystallized silicate melt. A_{si}—hydrous silicate glass. C_s—sulfide melt. V—CO_2-H_2O volatile fluid. $L_{CO2+CH4}$—liquid CO_2-CH_4. L_{H2O}—liquid aqueous. A—plane-polarized light. B—cross-polarized light.