Stepwise chemical extraction of potassium and argon from mica: An alternative way to obtain age spectra

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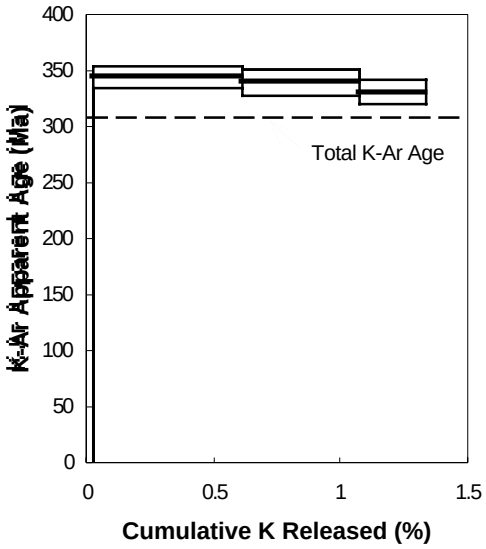
$^{40}Ar/^{39}Ar$ age spectra obtained by stepwise heating can be difficult to interpret in respect to the spatial distribution of radiogenic Ar relative to K in mica. An alternative way to obtain information on the spatial variation of radiogenic Ar relative to K in mica is to use an ion-exchange process that displaces K and Ar from interlayer sites, if the reaction works progressively inward from the periphery of each mica flake. A preliminary experiment on such extraction by exchange of K with hexadecyltrimethylammonium (HDTMA) ions in aqueous solution at room temperature gave the partial age



spectrum shown here for biotite from the Auburn Gneiss in Alabama.

Others have inferred that some excess radiogenic argon is present in Auburn biotites, and the partial age spectrum suggests that such excess argon may be concentrated toward the peripheries of the mica flakes. The experiment was not continued because the rate of exchange by HDTMA ions soon became impractically small at room temperature. A new apparatus now allows such exchange reactions to be carried out at elevated temperatures, opening the door to more complete exchange of interlayer ions by organic ions such as HDTMA as well as by inorganic ions. Others have shown that artificial weathering of mica by exchange with inorganic ions progresses inward from the peripheries of mica flakes. Reaction temperatures may be selected to give exchange rates appropriate for a practical schedule of extraction steps.

Origin of Ore-forming Fluids of MVT Pb-Zn Deposits in Kangdian Area, China

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There are seven large Mississippi Valley-type deposits in Kandian area, Sichuan and Yunnan provinces, China. They are hosted in carbonate rocks of Neoproterozic Dengying Formation and controlled by faults. The ore grade of Pb plus Zn reaches to 35% and the ore texture is characterized by colloform sphalerite and skeletal galena. The deposits formed during Jurassic.

It was widely suggested that the ore-forming fluids of the deposits derived from meteoric water based on hydrogen and oxygen isotope. According to the Na-Cl-Br systematics of the ore-forming fluids of the deposits, this study proposes that the ore-forming fluids derive from evaporated seawater and they was diluted by a lower salinity fluid derived from meteor water during ore formation.

Analyses of the fluid-inclusion leachates from the deposits rang*e* 75~358 Na/Br, 67~394 Cl/Br, and show the trend that coincides with the evaporated seawater trend on the basis of Na/Br and Cl/Br ratios. The average Cl/Br and Na/Br ratio of mineralizing fluids is 185 and 173, which are very closed to 120 and 233 of the ratio of the residual evaporated seawater past the point of halite precipitation. This suggest that the original mineralized brine derived from the highly evaporated seawater with high salinity.

However, the salinity of the inclusion-fluids ranges from 2.4 to 12.3 wt% NaCl equiv, most of which are lower than seawater. So the mineralized brine must be diluted. The values of $\delta^{18}O$ and δD of the ore-forming fluids vary −5.26 ~ 3.31‰ and −40.3~ −74.6‰, respectively. The δD values of meteoric water in the region were from −80~−100‰ during Jurassic. Therefor, we suggest that the ore-forming fluids originated from mixing the evaporated seawater with Jurassic meteoric water during ore formation.

Combined with the geology and geochemistry of the deposits, this study suggests that the ore-forming hydrothermal brines originally derived from highly evaporated seawater, which were responsible of leaching and carrying Pb, Zn and Fe. They were mixed with and diluted by descending meteoric water, causing the precipitation of the metals during Jurassic.

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