Large-scale metallogenesis of the Jiaodong gold deposits: Evidences of Ar-Ar and Rb-Sr isotopic ages

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The Jiaodong is a very important gold producer in China. Over ten large and super-large quartz-vein type and altered rock-type gold deposits related to Yanshannian granitic intrusions have been exploited in the northern part of the Jiaodong. In recent years, a new type of gold deposits (i.e. Pengjiakuang and Fayunkuang), hosted in brecciated fracture zones controlled by low-angle faults and located on the northern margin of the Jiaolai basin has been recognized.

With the rapid development of analytical techniques, Au-bearing minerals or paragenetic minerals in the ore can be directly used to determine ore-forming ages. The age of the pyrite Rb-Sr isochron from main mineralization stage of Linglong gold deposit was determined is 121~126 Ma. The age of the pyrite Rb-Sr isochron from bearing-pyrite phyllic rock of Xincheng gold deposit was determined is 116.6 ± 5.3 Ma. The results of quartz Ar-Ar dating and pyrite Rb-Sr isochron indicate that the ages of the Pengjiakuang gold deposit is 117.33~118.42 Ma, Dazhuangzi gold deposit is 117.39 Ma, and Fayunkuang gold deposit is 128.49 ± 7.2 Ma.

The consistency in metallogenic ages (120 ± 10 Ma) above gold deposits in the Jiaodong region suggests that these deposits were formed at the same metallogenic event. The authors suggest that the deep geological processes is one of the major processes induced large-scale metallogenesis in Mesozoic. The deep process mainly includes effect of deep-subduction of continental crust of the central orogen belt, lithospheric thinning and crust-mantle interaction. The large-scale magmatic activity origined by large-scale crust-mantle interaction plays a role of “engine”in the formation of the super-large gold deposits.

Origin of H_2 in mantle xenoliths: Implication to mantle fluid

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Hydrogen is one of the most important volatile in Earth’s interior, which plays an important role in Earth dynamic system (Bell,1992; Thompson, 1992; Wood,1997). Mantle-derived xenoliths contain an amounts of H_2, but occurrence mode of hydrogen is little known. In present paper the occurrence mode of H_2 in mantle minerals has been determined to reveal its significance for mantle fluid.

Experiment and results

H_2 contents from olivine (olv), orthopyroxene (opx) and clinopyroxene (cpx) of lherzolite and pyroxenolite (pxt) xenoliths in Damaping, eastern China have been measured by vacuum stepped-heating MAT271 mass spectrometer, in experiment CO_2, H_2O etc. were isolated with the rest components and remove from hot area to minimize the H_2 forming reactions among released gases by cool method.

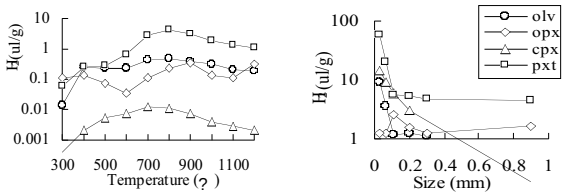

Figure 1 Relationship between H_2 contents with heating temperature (Lift) and sampe crushing size (Right)

H_2 contents released are related to the heating temperature and sample crushing size (Fig. 1), and show the features of fluid inclusion degassing. With increasing heating temperature H_2 contents shows a H_2 releasing peak around 800°C, virtually consistent with volatile degassing peak and homogenization temperatures (861-1074°C) of gas-liquid inclusions in mantle xenoliths (Zhang, 1999). With crushing size decrease, the H_2 contents from olivine, clinopyroxene and pyroxenolite increase rapidly, orthopyroxene have a H_2 releasing peak in crushing size of 0.1mm. In addition, absorbance peaks of OH at wavenumber of 3400±cm^{-1} of olivine and orthopyroxene infrared spectra have not significant reduction after sample degassed at 600 and 900°C compared with those dried at 120°C, which prove further H_2 derived from fluid inclusions instead of structural hydroxyl.

H_2 mainly occurs in the fluid inclusions in mantle xenoliths and exist as an independent phase in mantle fluid.

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