

Research Advances

Ore-Forming Mechanism of the Asikaerte Granitic Pegmatite Beryllium Deposit in Xinjiang, China

DING Xin¹ and LI Jiankang^{2,*}¹ School of Earth Sciences and Resources, China University of Geosciences, Beijing 100083, China² MLR Key Laboratory of Metallogeny and Mineral Assessment, Institute of Mineral Resources, Chinese Academy of Geological Sciences, Beijing 100037, China

Objective

Granitic pegmatite has great significance for studying magmatic-hydrothermal evolution, which is the main formation mechanism of rare metal deposits. Conventionally, granitic pegmatite rare metal deposits are regarded as crystallization from H₂O-saturated granite magma that formed in the late fractional crystallization of granitic magma. However, some scholars recently believed that the liquid immiscibility of granitic magma promoted the formation of pegmatite deposits. The Asikaerte beryllium deposit in Xinjiang, China, bearing metallogenic belts from lower granite belt to upper pegmatite belt, could benefit us to understand the formation of pegmatite through analyzing fluid and melt inclusions data.

Methods

The melt and fluid inclusions hosted in quartz or beryl in the Asikaerte deposit were observed under a Zeiss SCOPE.A1 microscope. A hydrothermal diamond anvil cell (HDAC) was used to apply external pressure on the quartz host to prevent its decrepitation caused by high internal pressure generated during homogenization. A Linkam THMS600 heating-freezing stage was used for the microthermometric measurements of fluid inclusions with relatively low internal pressure. The compositions of single melt and fluid inclusions were determined on a Horiba Labram XploRa Raman microprobe using an Ar ion laser (532 nm) with a power of 5 mW and a spectral resolution of 2.5 cm⁻¹.

Results

In the upper pegmatite belt, we found three types of fluid inclusions in beryl: CO₂-rich aqueous inclusions, crystal-rich inclusions, and a small amount of aqueous inclusions. Laser Raman analyses show that the crystals

within crystal-rich inclusions are mainly quartz, muscovite, calcite, cristobalite, dawsonite, sphalerite and other unidentified minerals (Figs. 1A(a)–(b)). In the lower granite belt, quartz mainly hosts melt inclusions, a small amount of aqueous inclusions, and secondary aqueous inclusions. The melt inclusions were composed of crystalline and fluid phases. The crystalline phases are mainly muscovite, albite, dicarbonate and fluorapatite (Figs. 1A(c)–(d)).

The homogenization temperatures of CO₂-rich inclusions in beryl of the upper pegmatite belt are 290–337°C, with the salinities of 3.2%–6.3% and density of 0.73–0.91 g/cm³. During heating in a HDAC, the crystal-rich inclusions in beryl from the upper pegmatite belt homogenized at 750–850°C with total dissolution of crystals into aqueous fluid phase; however, melt inclusions in quartz from the granite belt homogenized at 700–850°C with total dissolution of aqueous phase into melt phase formed by melting of crystalline phases (Fig. 1B).

Conclusions

The crystal-rich inclusions in beryl from upper pegmatite belt contain more H₂O than the melt inclusions in quartz from granite belt. The crystal-rich inclusions and melt inclusions have close homogenization temperatures, but they have contrasting homogenization behaviors that homogenized into aqueous and melt phases respectively. These features provide evidence for the occurrences of liquid immiscibility of granitic magma in the Asikaerte deposit, which possibly occurred at late magmatic evolution and separated into water-poor silicate melt and water-rich silicate-dissolving fluids. The latter evolves into pegmatite-forming fluid independently.

Acknowledgements

This work was financially supported by the National Natural Science Foundation of China (grant No.

* Corresponding author. E-mail: Li9968@126.com

41372088). We thank Prof. W. A. Bassett for his detailed revision of the report.

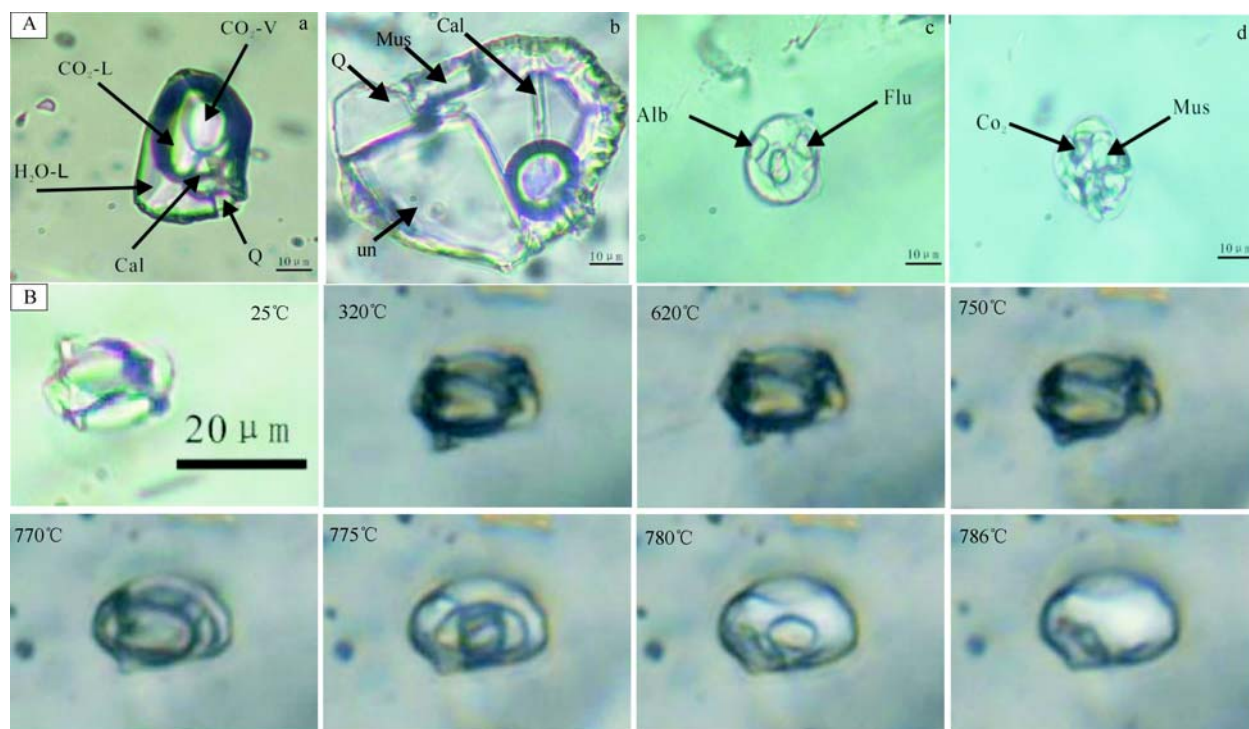


Fig. 1A. Photomicrographs of crystal-rich and melt inclusions in Asikaerte deposit; Fig. 1B. Photographs showing the homogenization process of a melt inclusion in quartz from the lower granite belt of the Asikaerte deposit.

The "a" and "b" images show the crystal-rich inclusions in beryl from the upper pegmatite belt; The "c" and "d" images show the melt inclusions in quartz from the lower granite belt. Mus-muscovite; Q-quartz; Cal-calcite; Alb-albite; Flu-fluorapatite; Un-unknown mineral.