Zircon morphology and geochemistry of the granitoids from the Huangshaping polymetallic deposit, South China: insights into magma evolution and mineralization

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The morphology of zircons may record a complex magma history. LA-ICPMS microprobe allows correlation between changes in zircon morphology and changes in the trace element chemistry, where the external morphology of zircons reflects the environment of crystallization, including magma composition, temperature and fluid participation.

Different types of mineralization in the Huangshaping deposit have been classified and attributed to three types of granitoids from the composite granitic pluton: quartz porphyry, granophyre and granite porphyry. Zircon grains from these granitoids have been classified into two types: Type 100 and Type 110. Zircons from the quartz porphyry mainly belong to Type 110, whereas zircons from the granite porphyry are predominantly classified as Type 100. The granophyre zircons are found in both types. On the other hand, most zircons from the quartz porphyry and the granophyre have well developed {101} pyramids that result in blunt edges and corners. In contrast, majority of the zircons from the granite porphyry have well-developed {211} pyramid, which show sharp edges in their spire angles. Additionally, there is a large variation between different types of granitoids in terms of trace element concentrations. Compared to the zircons from the quartz porphyry and the granophyre, zircons from the granite porphyry are more enriched in Th, U, Hf, Ti, and P but strongly depleted in Eu.

We conclude that the granite porphyry might have the highest magmatic crystallization temperature among these granitoids. The quartz porphyry and the granophyre are alkaline-rich whereas the granite porphyry is aluminous in bulk composition. In pace with the intrusive sequence, the aluminum concentration increased but the alkalinity decreased. This suggests that the magma that formed the granite porphyry possibly experienced stronger crystal fractionation and originated from a more evolved, complex magmatic source region with higher degree of crustal maturity, resulting in the large-scale W-Sn-Pb-Zn mineralization in this area.