Cathodoluminescence characteristics and Al, Ti contents of quartz in Xiangshan volcanic-intrusive complex, South China: New insight into magma evolution

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The Early Cretaceous Xiangshan A-type volcanic-intrusive complex, which located in Gan-Hang Belt, South China, consists of tuff, rhyodacite, porphyritic lava, granite porphyry and quartz monzonitic porphyry. The process of magma evolution, especially the contributions of mantle-derived magma, still remains controversial. The cathodoluminescence (CL) characteristics and analysis of Al, Ti contents in quartz from various rocks in the Xiangshan volcanic-intrusive complex have been carried out in this study, in order to unravel the magmatic evolution process of the volcanic-intrusive complex.

The results show that quartz grains in tuff and rhyodacite have relatively uniform CL characteristics, and the contents of Al and Ti in quartz grains remain the same from the core to the rim. The CL characteristics of quartz grains in porphyritic lava show gradually bright from the core to the rim. The Al contents remain constant, while the Ti contents increase gradually. The quartz grains in granite porphyry show the CL characteristics of obvious resorption texture, with a dark core and a bright rim and the boundary is very clear. The contents of Al remain the same from the core to the rim, but the contents of Ti increase significantly in the rim. The quartz grains in quartz monzonitic porphyry represent more complex CL characteristics, showing bright-dark-bright-dark zones from core to rim. They also have obvious resorption texture. The Ti contents change in different zones and the Al contents decline in the rim.

These CL characteristics indicate that the generations of tuff, rhyodacite and porphyritic lava were not affected by mantle-derived magma, while the resorption textures and Al, Ti contents of quaitz grains in granite porphyry and quartz monzonitic porphyry record the addition of mantle-derived magma in their petrogenesis. However, mantle-derived magma only provide heat to granite porphyry, while quartz monzonitic porphyry has been suffered thorough magma mixing.