

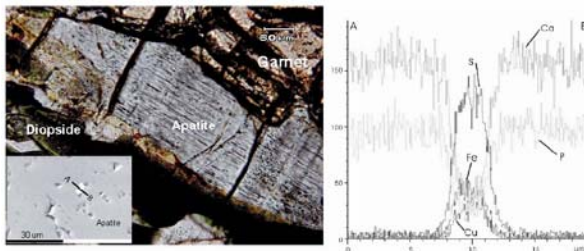
# Widespread occurrences of apatites with high density sulfide mineral solid exsolution in the Sulu eclogites

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Apatites with high density of sulfide mineral solid exsolution lamellae (up to ~30 vol%) are widely found in the Sulu eclogites (see Figure). From northeast to southwest, such apatites are found in Rongcheng, Rizhao, Qinglongshan, CCSD main borehole, and Sangqingge. These apatites are large (up to ~0.6mm×0.8mm) and occur as (1) inclusions within garnet or omphacite; (2) grain boundaries between garnet and omphacite; or (3) resolved and round apatite grains within the symplectite matrix of diopside, hornblende, and plagioclase. Such a texture relationship suggests (1) apatite is either a peak UHP phase or pre-UHP phase; and (2) high stability of apatites as they had survived intensive UHP and post-UHP metamorphic reactions. High resolution TEM and EDS observations show that apatite in Rongcheng kyanite eclogites have solid exsolution lamellae of FeS, CuS, ZnS, and PbS [1]; and of monazite, FeS, and CuS (or Cu<sub>2</sub>S?) from the Qinglongshan [2]. In contrast, solid exsolution lamellae within apatites from the Sangqingge eclogites enclosed within UHP marbles are exclusively FeS [3]. Sulfide mineral and monazite solid exsolution lamellae are subparallel to the C-axis of their host apatite, which suggests that their exsolution was strictly crystallographically controlled. Petrographic and geochemical observations show that solid exsolution-bearing apatites only found in those eclogites with TFeO greater than ~10.0 wt%. In addition, these eclogites have higher P<sub>2</sub>O<sub>5</sub> contents by at least a factor of 2 than those without apatites. These observations indicate that occurrences of these extraordinary apatites are controlled by the protolith geochemistry of eclogites. Coexistence of apatite with sulfide phases provides an excellent opportunity to study pre-UHP stable and radiogenic isotope geochemistry of UHP eclogites, behavior of accessory phases in deep subduction of continental materials, and thus gain insight into the pre-UHP conditions for the Sulu UHP rocks.



## References

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- [3] Zhu YF., and Massonne HJ. (2005) *Acta Petrologica Sinica* 21, 405-410