High-angle subduction: Triggers for formation of submarine volcanic-hosted iron deposits

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Submarine volcanic-hosted iron deposits refer to those that are hosted in submarine volcanic-sedimentary succession. They are one of the most important types of iron deposits in China, and have received much attention in recent years. These iron deposits have generally considered to form in an active continental margin. However, this type of iron deposits were only found in a few active continental margins, suggesting that they possibly formed in a special subduction setting. The previous isotopic dating suggests that iron mineralization and associated skarn alteration is coeval with the ore-bearing volcanic rocks. Hence, the iron deposits are genetically related to submarine volcanism. Our studies suggest that the ore-bearing volcanic rocks are a succession of tholeiitic to calc-alkaline basalt-basaltic andesite-andesite-dacite-rhyolite association with arc-like geochemical signature of negative Nb, Ta and Ti anomalies coupled with positive ε_{Nd} values, which implies that the primary magmas are derived from asthenospheric mantle, and experienced extensive crystal fractionation within crust-level magma chamber. The above geochemical characteristics reflect partial melting of mantle without involvement of oceanic crust, which suggest a thermal structure of warm mantle-cool crust in subduction zone. Considering the scenario that the iron deposits occur in submarine volcanic rocks in active continental margin, we correlate them to be resulted from high-angle subduction of oceanic lithosphere. The general characteristics and genesis of the submarine volcanic-hosted can be plausibly interpreted by this thermal structure model. The formation of the early stage of high-salinity magmatic fluids is correlated to crystal fractionation in magma chamber under compressional setting, whereas the magmatic fluids mixed with sea water can be attributed to be resulted from releasing of magmatic fluids under extensional setting.