Petrographical features of the Shilu Fe-polymetallic ore deposit in Hainan Province, South China: implication for ore-deposit type

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The Shilu Fe-polymetallic hematite-rich deposit is situated in the western Hainan Province of South China. This deposit is characterized by upper Fe-rich ores and lower Co-Cu-rich ores, which are mainly hosted within a dominantly metamorphosed submarine siliciclastic and carbonate sedimentary succession of the Proterozoic Shilu Group that has been metamorphosed to greenschist to amphibolite facies. Two types of metamorphosed BIFs, i.e. the quartz itabirites which contain alternating hematite-rich microbands with quartz-rich microbands, and the amphibolitic itabirites which comprise alternating millimeter- to a few tens meter-scale, Fe oxide (magnetite, hematite)-rich bands with calcsilicate (garnet + amphibole + pyroxene + epidote)-rich mesobands to microbands, have been identified within the Shilu Group. A Fe-Co-Cu-rich sulfide facies, represented by the stratabound Co-Cu ores, also characterizes alternating Co-bearing pyrite + Co-bearing pyrrhotite + chalcopyrite macro- to mesobands dominantly with dolomite + calcite ± amphibole and minor with sericite + chlorite + quartz macro- to mesobands. The relic oolitic, pelletoid, colloidal and psammitic textures, and bedding structures which most likely represent primary sedimentary structures often observed in the Shilu itabirites. Hereby, the precursor precipitates to the Shilu deposit are interpreted as Fe-Co-Cu-(Si)-rich chemical sediments intercalated or mixed with variable amounts of detrital components. Input of the Fe, Si, Co and Cu from a mixed source of weathered landmass and sea-floor-derived hydrothermal fluids into a continental margin marine basin separated from an open ocean in fluctuating redox state caused primary sedimentation of the Shilu itabirites and Co-Cu ores via hydrogeneous-sedimentary processes. Further, we consider the Shilu deposit as a BIF (banded iron formation) ore deposit-type (Lake-Superior).

Rapid recovery of seawater $^{187}Os/^{188}Os$ after CAMP magmatism at Triassic-Jurassic boundary

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The Late Triassic–Early Jurassic (T-J) was a time of major global change. The end-Triassic mass extinction is one of the "big five" extinction events of the Phanerozoic. The extinction is proposed to be causally linked with volcanic eruptions from the Central Atlantic Magmatic Province (CAMP)[1][2] which produced low $^{187}Os/^{188}Os$ ratios in seawater at the period boundary. Late Triassic to Early Jurassic organic-rich shales from SE Sicily offer an opportunity to track events across the T-J boundary. Here we present Re-Os geochemistry of Hettangian Streppenosa Formation black shales from Gela #1 drillcore, SE Sicily.

Black shales from the lower Streppenosa Formation, deposited in a deep euxinic intraplatform basin, yield a Model 3 Re-Os age of 200.3 Ma and initial $^{187}Os/^{188}Os$ of 0.87. This Early Jurassic age is nominally younger than the T-J boundary of 201.3 Ma[3] and the major four pulses of CAMP volcanism, dated between 201.6 and 200.9 Ma[2].

The seawater $^{187}Os/^{188}Os$ ratio of 0.87 at 200.3 Ma is the highest ratio recorded in Triassic to Early Jurassic seawater[4]. This ratio stands in contrast to mostly low ratios reported across the T-J boundary, attributed to the sudden initiation of volcanic activity of CAMP[1][4]. Yet the high $^{187}Os/^{188}Os$ coincides with an unusual spike in seawater $^{187}Os/^{188}Os$ at the T-J boundary[4]. The high $^{187}Os/^{188}Os$ ratio at 200.3 Ma documents minimal contribution of unradiogenic Os from CAMP magmatism, and may also reflect enhanced continental weathering resulting from uplift along newly formed rifted margins. This rapid recovery of seawater $^{187}Os/^{188}Os$ after CAMP volcanic eruption likely reflects the short residence time of Os in seawater (tens of kyr).

Our results confirm that the Os isotope composition of seawater responds rapidly to large volcanic events, further demonstrating the role that seawater Os can play in identifying major environmental changes.

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