Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.15472

Geochronological and geochemical constraints on the East Sulawesi Ophiolite with implications for tectonic reconstructions in Southeast Asia

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The East Sulawesi Ophiolite, one of the largest ophiolite suites worldwide, represents a key component of the late Mesozoic to early Cenozoic tectonic history in Southeast Asia and Australia [1]. We report first zircon U-Pb dating results for the ophiolite combined with radiogenic isotope signatures. Our results suggest a main seafloor spreading time for generating this ophiolite at 74 ± 3 Ma with zircon Hf isotope and apatite Nd isotope signatures both consistent with a depleted mantle source, with mean $eHf_{(74\ Ma)}$ and $eNd_{(74\ Ma)}$ values of +17 and +11, respectively. Samples from three different areas of the East Arm of Sulawesi show a conformity in ages and isotopic signatures, implying a relatively uniform crustal sequence and possibly single origin. Whole-rock major element geochemistry of gabbros and basalts shows a MORB-fractionation trend and their REE diagrams display a similar flat pattern with N-MORB, rather than E-MORB or OIB. Immobile trace element signatures of the gabbros, however, show different degrees of subduction influence and an affinity of back-arc basin basalts rather than Pacific MORB, suggesting that a possible subduction-modified mantle source was located beneath the original ridge similar to other reported locations [c.f. 2]. The different degrees of negative Nb-Ta-Ti anomalies among the samples in the incompatible element diagrams, coupled with elevated Th/Yb, indicate variable contributions of subduction-modified mantle input, even though crustal assimilation of cryptic origin cannot be excluded. The variable degree of the mid-ocean ridge vs subduction zone affinity may be controlled by the proximity to a potential back-arc [3]. We propose that a supra-subduction zone is a more plausible geodynamic setting for the generation of the ESO than an open ocean ridge environment based on current geochemical data in which oceanic crust is produced from subduction-modified back-arc mantle.

References

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