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Geochemical Systematics of Continental versus Island Arcs and Implications for Resource-endowed Continent Forming

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There are two typical crust standing on Earth, felsic dominantly continental crust and basaltic oceanic crust, with the former characteristic of thick block and corresponding above sea-level elevations as well as geochemically enriched in most of incompatible elements, making continent as the most accessible habitat and economic resources for human. However, the exact mechanism for generating such an endowed continent is still not well understood. Here, we investigate the geochemical systematics of volcanic arcs, which are considered as the most eligible candidate to build up continental blocks on basis of their chemical affinity. We show that arc lavas erupted on thickened crust are more enriched in incompatible metals compared with their thin island arc counterparts, which is inherited from increased incompatible element contents in primitive arc magma with rising eruption elevation. Such a metal enrichment in primitive arc magma and corresponding magmatic differentiation is enhanced with the increasing elemental incompatibility. A high compositional consistency between thick continental arc and upper continental crust (UCC) is observed, whereas thin island arc deviates from the UCC's formula, suggesting the materials contributing to UCC predominantly derives from thick continental arc instead of thin island arc. High continental arc, because of its thickening feature, feeds human with subaerial and economically endowed lands.