Microplate rotation triggers post-subduction metal endowment

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Giant ore deposits are rare but concentrated in few, well-endowed regions which must reflect unique magmatic and tectonic processes that control metal concentration and migration. The region of Papua New Guinea in the Western Pacific is particularly well-endowed in Cu and Au. Here, complex plate tectonic processes including subduction reversals, microplate formation and reorientations, and large-scale lithospheric extension have led to the formation of a number of world-class Cu and Au deposits. The major Cu deposits are associated with continent collision in the Miocene. The Au deposits are Pliocene and younger and are more closely linked to recent microplate tectonics [1]. One of those is the giant Ladolam porphyry-epithermal Au deposit on the island of Lihir in easternmost Papua New Guinea. Lihir belongs to one of four island groups in the Tabar-to-Feni chain that has emerged in the last 3.6 Ma from the New Ireland Basin, an older sedimentary forearc basin relative to the stalled Manus-Kilinailau Trench.

Here we present a new interpretation of the regional geodynamic framework integrating offshore areas. Following post-Miocene adjustments of the North and South Bismarck microplates, the New Ireland Basin underwent major lithospheric extension triggering post-subduction magmatism. Most of the erupted melts are shoshonitic and systematic trace element variations are recorded along the island chain: The Tabar and Lihir island groups for example indicate higher contents of fluid mobile elements relative to the Tanga and Feni island groups. Offshore seismic profiles image large normal faults between the individual island groups that are genetically linked to rifting of New Ireland and extension in the eastern Manus Basin. The geometry of the crustal blocks in the basin indicate that Lihir is located at the point of maximum extension of the rift. Thus, the combination of fertile melts and a permissive lithosphere may explain the anomalous magmatic and hydrothermal activity driving the regional endowment in Au.

[1] Holm *et al.* (2019) Ore Geol. Rev. **109**, 208-226.