A new MagellanPlus workshop proposal on drilling in the New Ireland Basin (PNG): Understanding the interactions between tectonism, volcanism, ore formation and the deep biosphere

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Strategic metals such as Cu, Au, Ag, As, Tl are essential for our current economy especially with respect to the development of energy-efficient green technologies. The majority of these metals are mined from deposits related to major crustal-scale fault zones and/or crustal growth at convergent margins (e.g., Sillitoe, 2010). Thus, the formation of ore deposits (‘metallogeny’) is closely linked to magmatism at convergent margins and the subsequent structural evolution of the crust. One area that is globally unique in terms of regional metal endowment related to recent plate tectonic processes, is eastern Papua New Guinea (PNG). Here, a number of large porphyry Cu-Au deposits (e.g., Grasberg, Panguna, Ladolam etc.) formed within the Neogene (e.g., Sillitoe, 2010). However, the microplate tectonics that ultimately localise magmatism and ore formation remain poorly constrained.

A key area in the microplate mosaic of eastern PNG, is the Tabar-Lihir-Tanga-Feni (TLTF) island chain, that forms the subaerial expression of four alkaline volcanic centres (e.g., Wallace et al., 1983) in the sedimentary New Ireland Basin (Exon & Tiffin, 1984). This basin formed in a forearc setting relative to southward subduction of the Pacific Plate along the Manus-Kilinailau Trench prior to docking of the oceanic Ontong-Java Plateau and subduction reversal in the Miocene. Ladolam on Lihir is the 3rd largest porphyry-epithermal gold deposit in the world and all of the island groups in the TLTF chain except Tanga (at least to our current knowledge) are well endowed in Cu and Au.

The key process that lead to volcanism along the TLTF island chain is microplate rotation and lithospheric extension (e.g., McInnes & Cameron, 1994; Brandl & Hannington, in prep.) leading to melting of metasomatically enriched portions of the lithospheric mantle (e.g., McInnes & Cameron, 1994; Franz et al., 2002; Kamenov et al., 2008). The TLTF island chain is globally unique in that a sedimentary basin, previously located in a forearc setting is now being displaced, stretched and magmatically overprinted. However, the detailed geological processes are yet to be investigated and scientific deep drilling provide a unique opportunity to study the subseafloor geology and to reconstruct the geological and geodynamic history of the region. The diverse range of scientific questions to be addressed in our pre-proposal offer the possibility of multi-disciplinary research and we consider this as the only way to resolve the regional tectonic, magmatic and metallogenic history. However, eastern PNG may work as a modern analogue for plate tectonic processes of the late Archean. Understanding the complexity of active microplate evolution may thus provide important insights into the processes of the Early Earth. Constraints gained from drilling in the TLTF regions will have a wide impact on research in the fields of structural and economic geology, understanding modern and ancient plate tectonics, microbiology (subseafloor life linked to hydrocarbons and sulphur reduction) and paleoclimate (microfossil record and climate reconstruction).

References:

Exon, N.F., Tiffin, D.L., 1984. Geology of offshore New Ireland basin in Northern Papua New Guinea, and its petroleum prospects, in:. Presented at the Transactions of the Third Circum-Pacific Energy and Mineral Resources Conference, Honolulu, pp. 623–630.

Franz, L., Becker, K.-P., Kramer, W., Herzig, P.M., 2002. Metasomatic Mantle Xenoliths from the Bismarck Microplate (Papua New Guinea)—Thermal Evolution, Geochemistry and Extent of Slab-induced Metasomatism. Journal of Petrology 43, 315–343.

Kamenov, G.D., Perfit, M.R., Mueller, P.A., Jonasson, I.R., 2008. Controls on magmatism in an island arc environment: study of lavas and sub-arc xenoliths from the Tabar–Lihir–Tanga–Feni island chain, Papua New Guinea. Contributions to Mineralogy and Petrology 155, 635–656.

McInnes, B.I.A., Cameron, E.M., 1994. Carbonated, alkaline hybridizing melts from a sub-arc environment: Mantle wedge samples from the Tabar-Lihir-Tanga-Feni arc, Papua New Guinea. Earth and Planetary Science Letters 122, 125–141.

Sillitoe, R.H., 2010. Porphyry Copper Systems. Economic Geology 105, 3–41.

Wallace, D.A., Johnson, R.W., Chappell, B.W., Arculus, R.J., Perfit, M.R., Crick, I.H., 1983. Cainozoic volcanism of the Tabar, Lihir, Tanga, and Feni Islands, Papua New Guinea: Geology, whole-rock analyses, and rock-forming mineral compositions (No. MF197), Report, Bureau of Mineral Resources, Geology and Geophysics. Canberra.

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