Redefining the genetic model of metal enrichment in Groote Eylandt manganese deposit: implications for the OAE2

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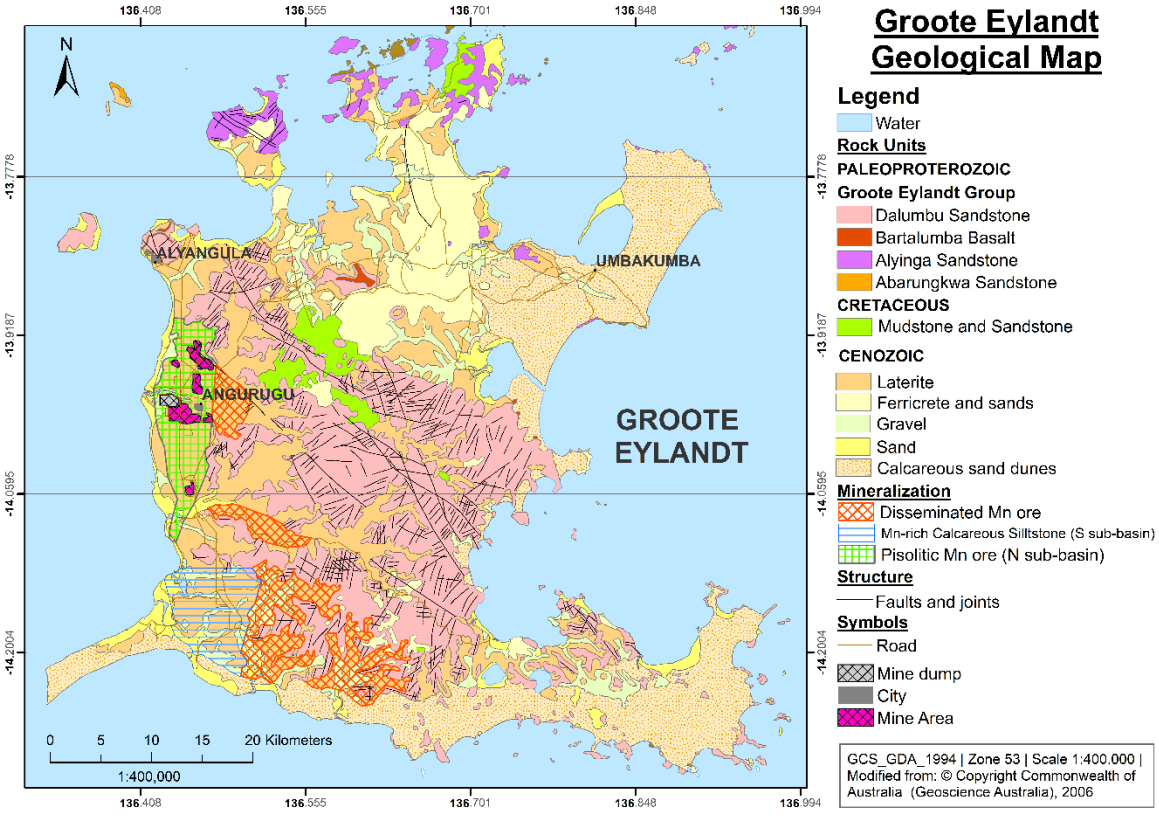
Because of funding from IOM3 and as the winner of the inaugural Hazel Prichard bursary, I was able to travel to the Groote Eylandt mine in Australia, engage in the mine workflow and take samples to perform geochemical studies for my master´s dissertation project which redefined completely the genetic model for this deposit. The Prichard bursary is named in honour of Dr Hazel Prichard, formerly of Cardiff University, and is awarded jointly by the Mineralogical Society of Great Britain & Ireland and the Geological Society in conjunction with their special interest groups: the Applied Mineralogy Group and the Mineral Deposits Studies Group.

The Groote Eylandt (GE) manganese deposit is one of the most important sedimentary Mn deposits in the world located on the Carpentaria Basin, Australia. The deposit is divided into two sub-basins, the northern one (NB), with pisolitic and massive ore and the southern one (SB), with disseminated carbonaceous ore. The pisolitic NB ore represents deposition on the swash intertidal zone whereas the SB ore was deposited in the subtidal zone. This study shows that the NB ore is not as supergene as previously thought and still conserves primary geochemistry. The deposit show enrichment in heavy metals and REE relative to PAAS (Post-Archaean Australian shales) values, with a potential economic source of the latter ones, with concentrations up to 619 ppm.

The source of Mn and metals in GE is not continental runoff as previously though. The deposit shows a Re-Os age of 93.22 ± 3.95 Ma, falling into the second great Oceanic Anoxic Event (OAE2) (~94.4 Ma to ~93.82 Ma[1]) and in the highest Cretaceous sea-level[2] recorded. This study points out the hydrothermal nature of the ore body and relates its formation to the emplacement of the Caribbean Large Igneous Province. Mn-rich beds are related to minimum detrital inputs reflected by a strong U, Co, Ni, Cu, Zn, Ba and REE enrichment relative to shale values and a strong positive Eu/Eu* anomalies. Redox sensitive trace elements ratios such as V/(V+Ni) and U/Th together with the absence of Ce/Ce* anomalies show the strong stratification of the water column at the time of deposition from dysoxic to euxinic waters. The Os_i value for both basins is ~0.71, which reflects the return to radiogenic Os signatures at middle stages of the OAE2 after the dramatic drop produced at its onset. The GE genetic model needs to be redefined to a sedimentary hydrothermal-related OAE2 deposit.



[1] Du Vivier et al., (2015).
[2] Haq (2014).