Temporal relationship of magmatism and mineralization between Qaradagh and Meghri plutons (NW Iran and S Armenia)

VARTAN SIMMONDS*[1], MOHSSEN MOAZZEN[2]

[1]Research Institute for Fundamental Sciences, University of Tabriz, Iran; Simmonds_vartan@tabrizu.ac.ir
[2]Geology Department, Faculty of Natural Sciences, University of Tabriz, Iran

Qaradagh pluton is located at northwest Iran, ~6-7 km south of Arax River. It lies in the Tertiary Orumieh-Dokhtar volcano-plutonic belt, formed by subduction of Neo-Tethyan oceanic crust beneath the Central Iranian plate during the Alpine orogeny. This belt hosts most of the major and small porphyry copper deposits and prospects in Iran. Its northern extension beyond the Arax River (S Armenia) is known as Meghri-Ordubad pluton, which also hosts several large porphyry Cu-Mo deposits, along with other occurrences of Cu-Mo-Au-Ag mineralization.

Qaradagh pluton hosts hydrothermal alterations and Cu-Mo mineralization developed within Eocene-Oligocene granitoidic rocks, which are resulted from emplacement and differential crystallization of several magmatic pulses including granite, granodiorite, diorite, syenite, monzonite, quartz monzodiorite and gabbro, while the granodioritic component is dominant.

Mineralization in Qaradagh pluton is mainly represented as stockwork-type and/or parallel swards of mono-mineralic and quartz±carbonate veins and veinlets. Ore minerals are mainly pyrite, chalcopyrite and molybdenite, accompanied by lesser amounts of bornite and dijenite. Investigations carried out on the mineralization in this region suggest the presence of a porphyry stock beneath it.

The model age estimated for the molybdenite samples based on Re-Os geochronologic method ranges between 25.19±0.19 Ma and 31.22±0.28 Ma, with an average of 27.59±0.23 Ma, which indicates that mineralization was a post-collisional event. The 46.9±9.5 Ma K-Ar age reported for granodioritic rocks of Qaradagh pluton corresponds to the ages obtained for the early intrusive units of the Meghri-Ordubad pluton, and are coeval with the host bodies in Agarak, Hankasar, Aygezor and Dastakert (Armenia). Meanwhile, the temporal pattern of mineralization here was coeval and contemporaneous with similar mineralizations in Kajaran (Armenia) and Paragachay (Nakhjavan) porphyry Cu-Mo deposits. Mineralization in Qaradagh pluton is occurred during middle to late Oligocene, long after the emplacement of the host rock in early to middle Eocene. All these data and the 6Ma time span indicate the episodic nature of magmatism-mineralization across the Megri-Qaradagh region.

Picrites and Ferropicrites: Mantle heterogeneity in a continental flood basalt setting

ELEANOR. S. JENNINGS*[1], SALLY. A. GIBSON[1], JOHN MACLENNAN[1], JUSSI S. HEINONEN[2], ARTO V. LUTTINEN[2], TEAL R. RILEY[3]

[1]Dept. Earth Sciences, University of Cambridge, Cambridge, UK. CB2 3EQ esj26@cam.ac.uk
[2]Finnish Museum of Natural History, P.O. Box 17, University of Helsinki, FI-00014, Helsinki, Finland
[3]British Antarctic Survey, Madingley Road, High Cross, Cambridge, UK, CB3 0ET

Picrites and ferropicrites from the early-Cretaceous Parana-Etendeka Large Igneous Province are primary mantle melts associated with the initial impact of the proto-Tristan mantle plume, and subsequent break-up of the South Atlantic. They are a rare example of primitive asthenospheric melts originating from beneath thick continental lithosphere. As their source melting regime is constrained at high pressures, these samples provide an excellent opportunity to identify a melt component from a more fusible (pyroxenite) source. We also look at a ferropicrite from Dronning Maud Land (the Karoo Province), Antarctica.

Ferropicrite is rare on Earth's surface and is exclusively associated with continental flood basalt provinces. It is thought to be similarly primitive and high-pressure as peridotite-derived picrite, though with a more enriched trace element composition, greater FeO concentration and reduced Al_2O_3. Although phenocrysts have lower forsterite contents ($<Fo_{85}$) than expected from primary mantle melts, their high temperatures and high Ni contents suggest this is due to a high melt Fe rather than low melt Mg. This contrasts with the Etendeka picrites, which represent normal high-pressure melting of peridotite mantle.

To explore the possibility that ferropicrite melts are derived from a pyroxenite source, we use the incompatible trace element geochemistry of olivine-hosted melt inclusions. These allow us to explore melt composition prior to most fractionation and contamination processes, as well as increase the sample size of these rare melts. It is often thought that mantle melts on continental crust will be complicated by contamination. However, in these samples, both whole-rock isotope and melt-inclusion trace element geochemistry indicate relatively little contamination. Trace elements in ferropicrite melt inclusions can be highly enriched and show fractionated HREEs, indicating high pressure melting of an enriched, fusible source, which may be garnet pyroxenite; we explore this possibility through trace element modelling.