Neoproterozoic eclogites and their evolution to garnet amphibolites from Hoggar (Tuareg Shield, South Algeria)

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Eclogites are a common feature of the Pan-African belts in the Tuareg Shield (Algeria, Mali and Niger) and there is now a consensus on the idea that modern style plate tectonics exist at least since the Neoproterozoic. They are formed in subducting slabs either of continental or oceanic affinity.

Eclogites from the Hoggar shield (South Algeria) are mostly located in the Central Hoggar (Egéré-Aleksod, Laouni, Azrou N'Fad, Serouènout terranes) and one occurrence in Western Hoggar (Tassendjanet terrane). Eclogite- facies assemblages in the Aleksod domain were recognised in metabasic lenses where P–T conditions have been estimated at > 15 kbar and 750 °C. These eclogites have been partially transformed into garnet-bearing amphibolites during decompression. In the Egéré domain, eclogite and the garnet amphibolite occur as lenses in marble, metapelite and quartzite. The high-pressure paragenesis (omphacite–garnet–rutile–quartz and epidote) was destabilised during decompression, giving rise to very thin symplectites of albite and jadeite-poor clinopyroxene, as well as amphibole–plagioclase symplectites separating garnet from omphacite and quartz. These eclogites define a P-T loop from 20 kbar - 700°C (eclogite facies) to 9 kbar - 700°C (retrograde amphibolite facies) through 14 kbar - 800°C (decompression heating). In the Laouni terrane, retrograde P–T paths are proposed to have involved decompression-heating from peak eclogite facies conditions of more than 15 kbar and ~790 °C to garnet amphibolite conditions of 12 kbar and 830 °C. In the Azrou N'Fad terrane, these rocks are only preserved in the core of isolated lenses whose margins have been pervasively amphibolitised. A metamorphic peak is calculated at approximately 760 ± 50 °C and at minimum pressure of 15 ± 1.5 kbar, with near-isothermal decompression leading to retrograde conditions of 700–750 °C and 11 ± 1.6 kbar. All these mafic eclogites, are retrograded to amphibolite-facies, except in the Serouenout and Tassendjanet terranes. The syn-collision exhumation occurs in granulite-facies before final amphibolitization. In the oceanic Serouènout terrane, granulitised eclogite rocks are associated with talc-kyanite whiteschists. Here, the peak omphacite (Jd30)–garnet paragenesis constrains eclogite facies conditions of 17kbar and 650 ± 50 °C, with the granulite facies overprint producing orthopyroxene-plagioclase symplectites at conditions of 10 kbar and 813 ± 60°C. In the Tassendjanet terrane, thermodynamic modeling has constrained a high-pressure clockwise P–T path, with peak eclogite conditions of 20–22 kbar and 650 °C followed by exhumation and heating to 10–14 kbar at 730 °C with orthopyroxene corona around amphibole, before the rocks cooled to conditions of 7–10 kbar and 610 °C.