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The Shanderman Complex (NW Alborz, Iran) and its significance for the Cimmerian event in northern Iran

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The Alborz orogenic belt is located in the northern Iran, between the city of Teheran and the South Caspian Basin. The Alborz belt originated during the Cimmerian orogenesis due to the collision between Cimmerian block of north Iran and the southern Eurasian margin. The Shanderman Complex is located north of Rasht in the southern part of the Talesh Mountains, a high relief massif wich reaches elevations of 2500 m just few tens of kilometers south of the Caspian basin.

The metamorphic and intrusive rocks of the Shanderman Complex occupy a lower structural position in the Alborz belt as they are covered by the Paleozoic sedimentary succession of Northern Iran, forming the Boghrov and the Masuleh Dagh thrust sheets. The contact between the two units is tectonic and the Paleozoic sediments display a week metamorphic imprint around Masuleh.

Both units are unconformably covered by conglomerates and sandstones of the Shemshak Fm, which, in this area, is of lower and middle Jurassic age (Clarke et al., 1972). The basal conglomerates of the Shemshak Fm contains serpentinite, eclogite and micaschists pebbles, testifying the exposure of the Shanderman metamorphics during the early Jurassic, after the Cimmerian collisional event.

Micaschists, garnet amphibolites and minor well preserved paragonite eclogites form the crystalline basement of the Shanderman Complex. The metamorphic basement have been later intruded by mafic intrusives with minor ultramafic cumulates and acid differentiates.

Micaschists and eclogites recorded at least two main deformational phases, while the

intrusives are almost undeformed. Decimetres to several meters thick sinistral subvertical shear zones crosscut both the metamorphics and the intrusives, causing the serpentinization of the ultramafic cumulates.

The mineralogy of the Shanderman eclogites is very rich : clinopyroxene, garnet, zoisite/epidote, paragonite, amphibole, phengite, quartz, rutile, titanite, calcite and plagioclase. The eclogitic phase assemblage is made of Na-clinopyroxene, garnet, paragonitic white mica, zoisite and quartz. The related P-T conditions of equilibration are of 600-650˚C and $P > 1.5$ GPa. This indicates depth of equilibration of at least 45 km. Relics of a phengite+barroisite/winchite+quartz+rutile phase assemblage are preserved within garnet cores, indicating HP and relatively LT conditions before the eclogite facies equilibration.

Small gabbroic to dioritic intrusive bodies, a few kilometres in extension, crop out in the Lachur Rud, Asalem Rud and near the Shalerah village, SE of Boghrov Dagh. These bodies often show a layered structure with abundant ultramafic cumulates ranging from dunite to wherlite and hornblendite. The most abundant lithology is a fine grained, medium to dark coloured, gabbro with 50-60% of mafic minerals. Plagioclase (An 30-40%) and Ti-poor green hornblende are the main constituent of this rock; magnetite, pyroxene, magmatic epidote and rare biotite are present as accessory phases. Whole rock chemical analyses of gabbros indicate an alkaline to transitional character, with low K_2O contents (< 1 wt %). The uneven distribution of incompatible elements (mantle/normalised), together with more or less pronounced negative Nb and Ta anomalies and HFSE abundances suggest a subduction-related character for these rocks.

The mafic and ultramafic rocks of the Shanderman Complex have been previously interpreted as an ophiolitic unit (Alavi, 1996), probably a relic of the Paleothetys crust consumed during the Cimmerian collisional event. The data here presented suggest a more probable volcanic arc origin for the Shanderman intrusives. Radiometric dating of eclogites are mandatory to define the relation with the volcanic arc intrusives. Eclogites may be considered of Cimmerian age, and so related to a subduction zone formed along the active Eurasian margin or alternatively related to older Paleozoic subduction phenomena occurred along the southern margin of the Eurasian plate.

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