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The EoCimmerian orogeny in North Iran

A. Zanchi (1), M. Mattei (2), F. Berra (3), S. Zanchetta (1), S. Poli (3), I. Villa (1), M.R. Ghassemi (4), J. Sabouri (4) and A. Nawab (4)

(1) Dip. Scienze Geologiche e Geotecnologie, Università di Milano–Bicocca, P. Scienza 4, 20126 MI-I, andrea.zanchi@unimib.it, (2) Dip. Scienze Geologiche, Università Roma Tre, Largo San G. Murialdo 1, 00146 Roma-I, (3) Dip. Scienze della Terra "A. Desio", Università di Milano, Via Mangiagalli 34, 20133 MI-I, (4) Geological Survey of Iran, Azadi Square, Meraj Ave., 13185-1494, Tehran, Iran

Evidence of the Paleotethys suture between the Eurasian margin and the Iranian block was firstly recognized in north eastern Iran around Mashad, where thin slices of meta-ultramafics associated with phyllites (Binalood and Virani regions) have been interpreted as an accretionary wedge formed during the EoCimmerian tectonic event (Alavi, 1991) taking to the collision of Iran with the southern active margin of Eurasia. Similar units are exposed from Mashad to the Afghan border, between Kopet Dag and the city of Torbat Jam. The whole collision zone is unconformably sealed by the flat-lying Middle Jurassic Kashaf Rud Fm., that post-date the final accretion of Iran to the southern margin of Eurasia.

Although most of the authors agree on the location of the suture zone in the Kopet Dagh area, its continuation to the west across central and western Alborz (Talesh Mountains) is still strongly debated. According to most of the authors, docking of the Iranian block to Eurasia occurred in the Late Triassic in the Alborz region and is marked by a strong unconformity between the late pre-Cambrian to middle Triassic successions of North Iran and the Norian to Early Jurassic Shemshak Formation, a thick terrigenous succession which is generally considered the "Cimmerian molasse".

Field data from the Alborz and Talesh Mountains indicate that the Shemshak Formation seals a complex tectonic setting where different major tectonic units related to the EoCimmerian orogeny can be identified.

Alavi (1996) suggests that the Palaeotethys suture extends westward from Mashad along the northern margin of the present-day Alborz chain on account of the interpre-

tation of the Shanderman Complex of the Talesh Mountains (western Alborz), as an ophiolite (Clark et al., 1975) equivalent to the Mashad units. New field data demonstrate that the Shanderman Complex represents a slice of deeply metamorphosed continental crust, as documented by the presence of eclogites that record the subduction of continental crust. The age of the eclogites is pre-Jurassic and probably related to the Eocimmerian collision: radiometric dating of the collected samples, necessary to confirm this idea, are presently in progress. An alternative hypothesis to the Eocimmerian age of these ecologites is that they could be related to the Palaeozoic structuration of the southern margin of the Eurasian plate, representing European-related nappes. The eclogitic phase assemblage, consisting of Na-clinopyroxene, garnet, paragonitic white mica, zoisite and quartz, indicate P-T conditions of equilibration of 600-650˚C and P $>$ 1.5 GPa, corresponding to a depth of at least 45 km. Relics of a phengite + Ca-Na-amphibole + quartz + rutile assemblage preserved within garnet cores indicate HP and relatively LT conditions before the eclogite facies equilibration. These metamorphics have been later intruded by mafic intrusives with layered cumulates including horneblendites and acidic differentiates. The presence of magmatic epidote within diorites suggests a depth of emplacement of at least 15 km pointing also to a lower continental crust setting. The interpretation of the Shanderman Complex as a remnant of continental crust involved in a collisional zone is confirmed by the geochemical features of the intruded gabbros. The uneven distribution of incompatible elements (mantle/normalised), negative Nb and Ta anomalies, and HFSE abundances suggest a subduction-related character. The most suited tectonic setting for their origin is a volcanic arc settled on a crust with transitional to continental characters. Boulders of the Shanderman Complex in the basal conglomerates of the Lower to Middle Jurassic Shemshak Fm. (Clarke et al., 1974), testify to its exposure and erosion at the end of the EoCimmerian orogeny.

A continuous belt consisting of low-grade metamorphic or not metamorphosed but strongly deformed units belonging to the northern margin of the Iran block occurs south of the metamorphic belt of the Shanderman Complex. In the west (Masuleh and the Siava Rud area in the Talesh Mountains), the outer part of the Eocimmerian belt consists of the Late Palaeozoic very low grade metamorphic units, covered by the post-Eo-Cimmerian Shemshak Fm. A complete section of the external part of the Eo-Cimmerian orogen is also preserved in the eastern Alborz across the Neka valley, south of Gorgan. Here the Mesozoic successions (Shemshak Fm. to Upper Cretaceous limestones), overlay with a sharp unconformity a pre-Jurassic Eo-Cimmerian thrust stack. This consists of the Gorgan Schists, a low-grade metapelitic and metavolcanic complex, which is overthrust southward above a strongly deformed Late Palaeozoic to Middle Triassic succession. Findings of achritarcs by GSI (1998) indicate a Late Ordovician - Early Silurian age for the Gorgan Shists, previously considered Palaeo-

zoic to Triassic in age (Alavi, 1996). The Gorgan Schists are therefore interpreted as the deformed and slightly metamorphosed Early Palaeozoic sedimentary succession of North Iran, that represented the external part of the Palaeozoic Palaeotethyan margin of North Iran, deformed, metamorphosed and thrust southward during the Eo-Cimmerian event. The boundary between the Eo-Cimmerian orogen and the foreland of North Iran is marked by the North Alborz Fault.

In the external foreland the Shemshak Fm. covers the successions of North Iran with a regional low angle unconformity. Extensional structures (graben and half grabens) predating the deposition of the Cimmerian molasses, have been here identified around Shemshak along the southern margin of the Central Alborz (Zanchi et al., 2006). These extensional structures were inverted during the Neogene tectonics that affected the Alborz, accounting for many of the peculiar characters of this belt.

References

- Alavi, M., 1991. Sedimentary and structural characteristics of the Paleo-Tethys remnants in northeastern Iran. Geological Society of American Bulletin 103, 983-992.

- Alavi, M., 1996. Tectonostratigraphic synthesis and structural style of the Alborz Mountain System in Iran. Journal of Geodynamics 21/1, 1-33.

- Clark, G.C., Davies, R.G., Hamzepour, G., Jones, C.R., 1975. Explanatory text of the Bandar-e-Pahlavi quadrangle map, 1:250,000. Geological Survey of Iran, Tehran, Iran, pp.198.

- GSI, 1998. Gorgan Sheet. Geological Survey of Iran, Tehran, scale 1:100,000.

- Zanchi, A., Berra, F., Mattei M., Ghassemi, M.R., Sabouri J., 2006. Inversion tectonics in Central Alborz, Iran. Journal of Structural Geology, 28, 2023-2037.