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Pennsylvanian to Early Triassic stratigraphy in the Alborz Mountains (Iran)

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We recognize five major sequences, that we interpret as 2^{nd} order sequences bounded by erosional surfaces or hiatuses, in the Pennsylvanian to Triassic of Central and Eastern Alborz. Bottom to top they are:

Gheselghaleh Sequence. Siliclastic to carbonate, max 150 m thick, Moscovian in age. Coastal marine to alluvial plain environment.

Dorud Sequence. A complex sequence, including a major transgression/regression cycle, from the Gzhelian to the Asselian or to lower Sakmarian. Thickness may exceed 350 m. It comprises at least four formations: Dorud 1 (informal name). Mostly siliclastic with few carbonate intercalations, this unit is interpreted to record the TST of the sequence, from continental to shoreface environment.

Emarat Fm. Prevailing carbonate unit, characterized by oncolithic cycles up to 10 m-thick and by fusulinid grainstone/packstone. Asselian in age. The unit should represent the HST of the sequence and its return to LST conditions.

Goshnavi Fm. The carbonate lithosome evolves upwards to grey dark packstone/wackestone deposed in more sheltered environment, in which the terrigenous input decreases or even vanishes.. Thicker beds are often dolomitized.

Dorud 3 (informal name). Mostly developed in Central Alborz, it consists of siltstones, shales and subordinate varicoloured sandstones. Sakmarian in age. Deposition in transitional environments fed with detritus from a fairly mature alluvial system.

Ruteh Sequence. Monotonous succession of grey well-bedded bioclastic packstone

and wackestone with crinoids, brachiopods, foraminifers and algae. It the middle and upper parts, thin cherty nodules are present. Thickness between 150 and 250 m. Only in the Emarat anticline it reaches the anomalous thickness of 600 m. Very spread, this sequence disappears southwards and along the Gheshlagh-Ghosnavi belt in Eastern Alborz. It is capped by an emersion surface, lined by karst features and lateritic horizons. The basal TST is rich in macrofossils of Middle Permian age. Consequently the gap Dorud/Ruteh lasts around 20 MY. The top of the sequence is around the Middle/Upper Permian boundary. Ruteh Fm. was deposited on a carbonate ramp near the fair weather wave-base or just below.

Nesen Sequence. This last Permian sequence is spread over large part of the Alborz, and is represented both by continental and marine facies. Its thickness does not exceed 200 m, but it may be reduced to a few m. The continental facies is represented by the Gheshlagh Fm., characterized by spells of fluvial quartzarenites overlain by lateritic horizons. To the north and to the west, the shales of the lower part of the Nesen Fm are considered the lateral and distal equivalent of the Gheshlagh Fm. The environment of the Gheshlagh Fm. is transitional from a mixed siliciclastic/shallow high energy carbonate flat to a continental alluvial plain and with lateritic episodes testifying to warm-humid climate.

Nesen Fm. The lower lithozone consists of dark grey splintery shales interbedded with nodular marly limestones. The upper lithozone, with chert nodules, records an increase of the wackestone up to mudstone-dominated microfacies. The Nesen Sequence thins out rapidly to the S and its age is Late Permian. The environment is interpreted as a not very deep ramp on which initially expanded the distal part of a terrigenous apron fed by the emergent areas. When clastic input decreased, sedimentation on the ramp was mostly carbonatic, with chert derived by the diagenesis of radiolarian.

Elikah Sequence. This sequence, being rather uniform over the whole range, consists of several lithozones or members. The lowermost is made by thick-bedded, grey mudstone/wackestone, up to 15-20 m-thick. Domal or planar stromatolites and biolithites are widespread. Where the Nesen Sequence is topped by an emersion surface, the lower boundary consists of yellow-grey dolostones overlain by the second lithozone, with alternating thin-bedded mudstones, densely bioturbated, gastropod ooidal packstone, breccias**,** pink marls, and reddish fine arenites. Thickness around 100-150 m. The third unit consists of thin bedded, grey recrystallized limestones or dolostones, 50-100 m thick. The fourth unit is made of thick bedded to massive, light grey coarse dolostones, cliff-forming, up to 300-m thick. The uppermost unit consists of light grey-bedded limestone (packstone/wackestone), up to 50 m-thick. The Elikah sequence is truncated by an erosional surface, and the younger formations often overlies it with an angular unconformity. The Elikah Fm. spans up to the early

Late Triassic. The boundary between Nesen and Elikah fms. roughly corresponds to the Permian/Triassic boundary. It was deposited on a wide flat plain, submerged by a very shallow sea for most of time, with fairly homogeneous gradients. The terrigenous input was scarce or absent, suggesting low land relief and absence of major rivers. The absence of evaporitic deposits it to be noted.

Depositional and geodynamic interpretation. The first 4 sequences had their depocenters to the N of the Alborz Range, whilst Elikah show a different pattern. The Pennsylvanian to Early Triassic of Central and Eastern Alborz display close affinities with the Central Iranian blocks of Tabas and Anarak, sharing similar facies and timing of transgression/regression and unconformities. Some affinities exists also with the sedimentary belt of Abadeh-Shahreza. Timing and facies are totally different from those at the margin of the Arabian Plate. Whilst on the Arabian passive margin sedimentary evolution is tuned with the glacioeustatic signal, in Alborz and Central Iran it appears to be in phase opposition with it at the end of Carboniferous and during the Early Permian. Interpretations of this point are discussed.