Geophysical Research Abstracts,
Vol. 11, EGU2009-3653-6, 2009
EGU General Assembly 2009

Norian-Bajocian (Shemshak Group) extension in Alborz (north of Iran)

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Based on kinematic analysis of fault sets in the Late Triassic to Middle Eocene deposits and reconstruction of Paleostress tensors, this study provides a coherent model of tectonic evolution of northern Iran since the Cimmerian orogeny in Middle-Late Triassic to Early-Middle Eocene.
In Middle to Late Triassic the Gondwanian Cimmerian blocks collided with the Turan plate, already accreted to Eurasia. It is the Eo-Cimmerian orogeny that is completely achieved in Norian time. The age of the beginning of this major regional event is still questionable in Middle Triassic because the age of the pre-collision platform carbonates of the Elika Formation is poorly constrained. In the southern part of Alborz Cimmerian deformations are very low and no angular unconformity exists between the pre and post-collision deposits.
Shemshak Group (Norian-Bajocian) is a key for the understanding of the regional tectonic evolution, we investigated the brittle deformations in several areas of Central Alborz such as North Tehran, Baladeh valley and Galandrud area in South of Amol and we determinated syndepositional normal in these sites. The most common tectonic features in the Shemshak Group are populations of normal faults and strike-slip faults. This tectonics often erased the original deformations, such as the syndepositional ones.
During the Late Triassic to Early Bajocian times, Shemshak Group experienced extensional tectonics, which led to the establishment and development of sedimentary basins. The Shemshak Group is clearly associated with an extensional event. We evidenced a syn-depositional N-S to N30E extension in the Shemshak Group in Alborz. The conclusions of the structural study are in agreement with the results of the subsidence analysis conducted independently from stratigraphic data. We claim that this extensional event is the rifting that originated in Mid-Late Jurassic the opening of the oceanic South Caspian basin. This extension is probably non-restricted to northern Iran. It generated riftings in the Late Triassic to Liassic period that originated the opening of several oceanic basins in Central Iran, of which relics are preserved in the ophiolites of Central Iran.
In all sites, even where no syndepositional tectonics were observed, the normal faulting occurred before the folding of the Shemshak beds as indicated by the attitude of the mean stress axe, contained in (2 and 3) or perpendicular (1) to the bedding planes on the diagrams. Because the first inversion in the Alborz and Kopet-Dagh range occurred at the Jurassic-Cretaceous boundary, these pre-folding normal fault populations of the Shemshak Group are not younger than Jurassic.
In this subsection, we refer to 30 stress states which correspond to brittle tectonic that syndepositional with normal fault related to the Late Triassic to Early Bajocian. Sixteen of these Paleostress tensors are of good quality. The major results in term of direction of extension (3 directions) determinated in Shemshak Group are displayed on a map. Several directions of extension have been determinated. Despite the general consistency, the reconstructed extensional stress at 7 sites showed that the extension also was 040°. This extension associated with E-W to WNW-ESE trending normal faults.
In the Baladeh valley, minor fault have been measured in the Shemshak Group. The 090° to 125° conjugate dip-slip normal faults documents a NNE-SSW to NE-SW oriented extension. In the other parts, the NNW-trending faults are oblique normal faults and also indicate a NNE-SSW oriented extension.
In summary, we found three directions of extension that have been identified in the Shemshak Group, with one direction major 040° (from 026° to 058°), and two directions minor include of NNW (almost 345°) and WNW-ESE (from 203° to 218°). One may interpret these three trends as the expression of independent extensional events. However, we believe that it is more reasonable to interpret them as part of a single major extensional period (040°), characterised on the whole by a low average ratio between principal stress differences or rotations of the extensional trends. This first direction of 040° directed extension was established as early as the Norian to Early Jurassic, as evidenced by syndepositional faulting in the Shemshak Group. Following the first extensional,

two NNW and WNW-ESE directed of extension have been observed in the same locality and age, in our opinion they were relative to Eocene extension phase.