

Late Cretaceous to Late Tertiary States of Paleostress in the Foreland Fold Belt in Northern Iraq

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Abstract

Analysis of brittle failure structures has been carried out for (22) sites in different parts of the Foreland Fold Belt of northern Iraq. These structures include joints, faults, veins together with stylolites. Geometrical and genetic analysis of joints revealed several joint sets and systems including two sets of tensional joints and four conjugate shear systems. One of the tensional sets is parallel to the fold axes and the other is perpendicular. The conjugate shear joints in the areas of study comprise (1) two main conjugate systems each of which consists of two conjugate sets or a singular shear set. These are perpendicular to the bedding planes and have definite angular relationship with the fold axes, and (2) two secondary systems each of which consists of joints that are parallel or perpendicular to the fold axes with different angular relationships with the bedding planes. The planar veins are widespread over all the areas of study and are usually associated with two conjugate shear systems (or singular shear joint sets). They have acute or obtuse angles with the axes of the folds in which they exist. Lenticular veins on the other hand represent tensional stresses. Associated with the lenticular veins are two sets of stylolite surfaces, one parallel and the other perpendicular to the fold axes. A third set of stylolite surfaces is parallel to the bedding planes with a perpendicular dentition indicative of syn-depositional age of formation due to the stupendous weight of the overlying strata.

It is concluded from the association of the stylolites with the sets of lenticular veins in the High Folds Zone (Dokan area) that the area of northern Iraq was subjected throughout its geological history from the Cretaceous to two alternating directions of tectonic compression; one was perpendicular and the other one parallel to the fold axes. The same alternating directions of tectonic compression were elucidated from the dynamic analysis of the faults and associated shear joints in the different areas of the present study.

The faults exposed in the areas have been identified as primary and secondary according to their extensions and the resulting displacements. Dynamic analysis of the faults together with the associated shear joints revealed twelve states of paleostress which affected the area of northern Iraq from the End-Cretaceous to the End-Tertiary times.

The analysis has shown that the area of northern Iraq is characterized by prevailing wrench tectonism where strike-slip displacements predominate over reverse and normal displacements. According to the stress ratios (R) each of the twelve paleostress states is subdivided into secondary states. However they have been categorized into two directions of tectonic compression in northern Iraq, namely perpendicular and parallel to the fold axes of the Taurus and Zagros ranges. Each of the above directions of tectonic compression has alternately fluctuated between strike-slip, reverse and normal displacements by principal stress axes (σ_1 , σ_2 , σ_3) permutations. Nevertheless the strike-slip displacements were the predominant ones.

Keywords:- Paleostress, Dynamic analysis, Stress permutations, Wrench tectonics