

Statistical analysis of the structural evolution of western Qaidam Basin

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Qaidam Basin is located in the northern bordering zone of the famous Qinghai-Xizang Plateau, and the tectonic evolving history of the plateau should be typically recorded by the sediments in the basin. However, traditional methods for studying tectonic evolution of a sedimentary basin are mostly qualitative, and, therefore, not capable of delineating quantitatively the tectonic evolution process, though recent geophysical methods can provide detail images of the surface structures. In this paper the tectonic evolution of the basin is studied by using three statistical parameters derived from five structural surfaces in the western part of Qaidam Basin.

The parameters comprise the degree of roughness of structural surface (R), the azimuth of long axis of the second order polynomial trend surface (LA), and the simple average crustal subsidence rate (SSR) of each evolutionary stage. The degree of roughness describes the roughness of a structural surface. It is well known that an undisturbed sedimentary bedding is smooth and horizontal, though there may be 1 to 5 degrees of inclination. A surface will be roughened by tectonic deformation, and the intensity of deformation can be approximated by the roughness of the surface. The second order polynomial trend surface derived

from a generally concave basin structural surface will always be an ellipse, from which the long trend axis is found parallel to the contemporaneous compressive stress axis, and the short trend axis manifests the extensional stress. Subsidence rate, the third parameter, will characterize the vertical component of the tectonic movement.

The tectonic evolution of western Qaidam Basin is successfully studied, though the resolution of the study is limited by the number of and intervals among the structural surfaces. Values of R show that the younger the surface the larger the value. LA of the three older surfaces are surprisingly identical, illustrated a N-S extensional stress, the youngest surface has, however, a perfectly different stress field, characterized by E-W extension, and the fourth surface shows reasonably in a transitional character. All four stages defined by the five structural surfaces have different values of SSR . The first stage, which is the oldest, has the lowest SSR , the highest one comes from the third stage and youngest stage the second.

Based on these values, the tectonic evolution of western Qaidam can be summarized as follows: From Jurassic to Miocene, the basin with slow subsidence rate and gentle deformation was

controlled by the N-S extensional stress. During early to middle Pliocene, the stress field was transitioning from N-S extensional to N-S compressive, and the deformation and subsidence were enormously intensified. Since Late Pliocene the basin gradually

died out under the N-S compression with still rather high values of roughness and subsidence. This evolution pattern is in accordance with the development of the Qinghai-Xizang Plateau.
