



## **Caldera-like non-volcanic cavities – catastrophic finish of the long-term neotectonic process**

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Unusual geomorphic features – caldera-like semi-rounded Kyzylkiol and Djuzumdy cavities at the watersheds of the ranges representing neotectonic basement anticlines have been found out in the Central Tien Shan. Their only one possible analogue described in the literature had occurred in 1957 during the M8.1 Gobi Altai earthquake in the central part of the Ihe Bogdo Range on the slope of the Bitut valley where about 2 km long and several hundreds meters wide block subsided catastrophically from 156 to 328 meters. Formation of both the Bitut and the Tien Shan cavities was associated with catastrophic collapses and 'disappearance' of large amount of rocks in the ridges' interiors. Their volumes range from few hundreds of millions cubic meters in the Djusumdy and Bitut cases up to  $\sim 3$  billions cubic meters in the Kyzylkiol case. While the Djusumdy cavity located within the granite massif is of the same order of size as the Bitut one, the most expressive Kyzylkiol cavity is much larger, being about 2.3 km in plan view and 500 to 700 m deep. The ridge affected by this feature is composed of intensively folded Early Paleozoic metasediments intruded by granites and small mafic bodies. At the northern slope of the ridge Early Paleozoic metasediments are overlaid by monoclinical Carbon red beds of the Dungurminskaya Series. Red-colored debris originated from these red beds paints lowermost parts of the slopes of the Kyzylkiol creek valley that drains the cavity. It indicates that originally the cavity was closed and that its southern wall was dissected later by back erosion. Small part of the cavity bottom was eroded too and washed out through the Kyzylkiol creek valley, while its main part remains intact and represents smooth flat surface slightly inclined to the south. Thus the cavity is definitely non-erosional geomorphic feature.

Any explanation of these phenomena requires the comparable 'free space' in the ridges interiors (in the cores of neotectonic anticlines) that can accommodate the collapsing rock mass. However, it can be produced neither by volcanism, nor by karst or any other exogenetic process. Since the geomorphic observations clearly show that well-developed erosional relief had been formed at the arch areas of neotectonic anticlines prior to the cavities' formation it is hypothesized that large-scale collapses represent just the final stage of some long-term neotectonic process. I speculate that it could be the detachment basement folding in tectonically stratified upper crust that led to formation of the 'tectonic caves' in the anticline core zones, which progressive collapse finally results in the above cavities formation.