Geophysical Research Abstracts
Vol. 19, EGU2017-1570, 2017
EGU General Assembly 2017

Structural controls on Eocene to Pliocene tectonic and metallogenic evolution of the southernmost Lesser Caucasus, Armenia: paleostress field reconstruction and fault-slip analysis

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The Cenozoic evolution of the central segment of the Tethyan belt is dominated by oblique convergence and final collision of Gondwana-derived terranes and the Arabian plate with Eurasia, which created a favorable setting for the formation of the highly mineralized Meghri-Ordubad pluton in the southernmost Lesser Caucasus. Regional strike-slip faults played an important role in the control of the porphyry Cu-Mo and epithermal systems hosted by the Meghri-Ordubad pluton.

In this contribution we discuss the paleostress and the kinematic environment of the major strike-slip and oblique-slip ore-controlling faults throughout the Eocene subduction to Mio-Pliocene post-collisional tectonic evolution of the Meghri-Ordubad pluton based on detailed structural field mapping of the ore districts, stereonet compilation of ore-bearing fractures and vein orientations in the major porphyry and epithermal deposits, and the paleostress reconstructions.

Paleostress reconstructions indicate that during the Eocene and Early Oligocene, the main paleostress axe orientations reveal a dominant NE-SW-oriented compression, which is compatible with the subduction geometry of the Neotethys along Eurasia. This tectonic setting was favorable for dextral displacements along the two major, regional NNW-oriented Khustup-Giratakh and Salvard-Ordubad strike-slip faults. This resulted in the formation of a NS-oriented transrotational basin, known as the Central magma and ore- controlling zone (Tayan, 1998). It caused a horizontal clockwise rotation of blocks. The EW-oriented faults separating the blocks formed as en-échelon antithetic faults (Voghji, Meghrasar, Bughakyar and Meghriget-Cav faults). The Central zone consists of a network of EW-oriented sinistral and NS-oriented subparallel strike-slip faults (Tashtun, Spetry, Tey, Meghriget and Terterasar faults). They are active since the Eocene and were reactivated during the entire tectonic evolution of the pluton, but with different behaviors. During the Eocene, dextral displacement along the NS-oriented strike-slip faults were favorable for the opening of NE-oriented en-échelon normal faults. The NS-oriented faults, in particular at their intersection with EW- and NE-oriented faults, were important ore-controlling structures for the emplacement of major porphyry Cu-Mo (Dastakert, Aygedzor and Agarak) and epithermal (Tey-Lichkvaz and Terterasar) deposits. In summary, we conclude that from the Eocene to the Oligocene the dominant structural system consisted essentially in dextral strike-slip tectonics along the major NS-oriented faults.

During the Oligocene to Miocene, NS-oriented compression and EW-oriented extension predominated, which is consistent with the collisional and post-collisional geodynamic evolution of the study area. This setting resulted in renewed dextral displacement along the NS-oriented ore-controlling faults, and sinistral displacement along the EW-oriented antithetic faults. This setting created the favorable geometry for opening NS- EW- and NE-oriented extension fractures, and the adequate conditions for the emplacement of vein-, stockwork-type porphyry deposits, including the giant Kadjaran deposit.

During the Lower Miocene to Pliocene there was a rotation in the main regional stress components according to progressive regional evolution. Paleostress reconstructions indicate a change in compression from NS during the Miocene to NNW during the Pliocene. The Tashtun transcurrent fault had an oblique-slip behavior. It formed a negative flower structure with a sinistral strike-slip component, which resulted in the development of a pull-apart basin and the formation of the Lichk porphyry-epithermal system.