Geophysical Research Abstracts,
Vol. 11, EGU2009-1026, 2009
EGU General Assembly 2009

Morphological and sedimentological evidences of repeated avulsions of Someşu Mic River (Romania), associated to salt tectonics

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Over the last decades, the Holocene evolution of the rivers became an important topic for the scientific community. Whereas most of these studies emphasized the role of climate in the rivers' evolution, little attention has been paid to tectonics, especially at small scale. Here we present a model of Holocene river evolution from the Transylvanian Basin (Romania), where salt tectonics plays an important role.

Someşul Mic River (105 km long, 20 mc/s) is located in the NW part of the Transylvanian Basin, Romania. It has a dranage basin of 3773 km2 and the catchment's area is located in the Apuseni Mountains. The river has a well-developed floodplain, with a length of 75 km (calculated along its axis) and an average width of 2 km. In the upper sector, the river flows on red clays, sandstones and limestone of Eocene and Oligocene age (disposed in monoclinal strata), while in the lower sector, the bedrock consists of marls and volcanic tuffs of Miocene age, affected by diapiric alignments. The sedimentary structure of the floodplain is simple, with coarse Lateglacial gravels at the bottom and more fine Holocene sediments (pebble, sand, clay and silt) in its upper part; but some deviations from this general model, attributed to active tectonics, are observed along the river (e.g., absence of the coarser complex, variable proportion of the two complexes, etc). The main characteristic of the river is the high degree of alternation of channel types, from sinuous, meandering and even braided, to anabranched reaches.

In order to decipher which mechanism is responsible for the development of the floodplain, we have analyzed in detail a section of the river, using a combination of high-resolution topographic surveys, electrical imaging, core drilling and granulometric analyses. In the investigated area, the river flows on Miocene marls partly covered by sediments, having a sinuous reach, with 2-3 m high banks. To the east, a diapiric syncline stretches parallel to the valley. Four palaeochannels are visible on the floodplain's surface, these being also evident in the sedimentary structure of the valley infill, as revealed by the electrical imaging and drilling. Former channel infills consist mainly of massive and sandy clays (low electrical resistivity – 5.8 ohm.m), whereas the sectors between them are filled by pebbles and sands interpreted to be channel deposits (high values of the electrical resistivity – 80 ohm.m).The absence of coarse gravels from the bottom, direct disposal of fine sediments on marls and the presence of massive clay suggests 3 stages in the channels evolution. The first one is a long period of stability, supposed to be associated to a low sinuous course, when river incised the sedimentary complex of the floodplain, until it was intersected the valley bottom. The second stage is an abrupt avulsion to the right, produced probably during an important flood, and the third stage corresponds to the period of complete abandonment of it and the evolution as oxbow lake. If we take in consideration the presence of the diapiric syncline on the right side of the valley, and the disposal of parallel channels with it (including the present-day one), we conclude that this behavior is caused by a lateral tilting of the floodplain trough the right.