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Integrative geomorphological mapping approach for reconstructing meso-scale alluvial fan palaeoenvironments at Alborz southern foothill, Damghan basin, Iran

Christian Büdel (1), Seyed Majid Padashi (2), and Roland Baumhauer (1)

(1) Insitute of Geography & Geology, Bavarian Julius-Maximilians-University Würzburg, Germany (christian.buedel@uni-wuerzburg.de), (2) Stratigraphy Group, Geological Survey of Iran (GSI), Iran

Alluvial fans and aprons are common depositional features in general Iranian geomorphology. The countries major cities as well as settlements and surrounding area have often been developed and been built up on this Quaternary sediment covers. Hence they periodically face the effects of varying fluvial and slope-fluvial activity occurring as part of this geosystem. The Geological Survey of Iran therefore supports considerable efforts in Quaternary studies yielding to a selection of detailed mapped Quaternary landscapes.

The studied geomorphologic structures which are settled up around an endorheic basin in Semnan Province represent a typical type of landform configuration in the area. A 12-km-transect was laid across this basin and range formation. It is oriented in north-south direction from the southern saltpan, called "Kavir-e-Haj Aligholi"/"Chah-e-Jam" ("Damghan Kavir"), across a vast sandy braided river plain, which is entering from the north east direction of the city of Shahroud. At its northern rim it covers alluvial sediment bodies, which are mainly constituted by broad alluvial aprons, fed by watersheds in Alborz Mountains and having their genetic origins in Mio-/Pliocene times.

During this study a fully analytical mapping system was used for developing a geodatabase capable of integrating geomorphological analyses. Therefore the system must provide proper differentiation of form, material and process elements as well as geometric separation. Hence the German GMK25 system was set up and slightly modified to fit to the specific project demands. Due to its structure it offers most sophisticated standards and scale independent hierarchies, which fit very well to the software-determinated possibilities of advanced geodatabase applications.

One of the main aspects of mapping Quaternary sediments and structures is to acquire a proper description and systematic correlation and categorization of the belonging mapping-objects. Therefore the team from GSI and University of Würzburg performs additional geochronologic and stratigraphic studies of different alluvial surfaces in the investigation area. Relative and absolute dating methods are applied, as well as non-invasive and invasive methods for studying subsurface sedimentation and layering.

The ongoing mapping work has revealed a progradational sequence of at least five more or less dissected surfaces of alluvial deposits. These can be distinguished by optically taken morphometric and spectrometric parameters and material reflectance using remote sensing imagery data. An important role for geomorphometric measurements and landform identification was occupied by DEM data. In the field these parameters could be correlated with differently developed covers of desert pavement, and changes in curvature, roughness and levels of sediment surfaces.

The studied alluvium has been formed by several phases of debris flow activity and braided river dynamics over a distance of more than 3.5 km and is reworked recently. Gradual differences in structure and form may be linked to changes in depositional process and quaternary environmental development as well as neotectonic activity. Future correlation between alluvium and sediment cores from the playa is targeting on better understanding of depositional milieus during activity phases.