Geology, geoarchaeology or ethnogeoarchaeology? Landscape reconstruction at the Chehrabad salt mine (Zanjan, Iran) since the Achaemenid Period

Draganits, Erich (University of Vienna, Vienna, AUT);
Khoshraftar, Reza (University of Zanjan, Zanjan, IRN);
Saeedi, Sahand (Deutsches Bergbau-Museum Bochum, Bochum, GER);
Schimerl, Nicolas (Ruhr-Universität Bochum, Bochum, GER);
Aali, Abolfazl (Archaeological Museum of Zanjan, Zanjan, AUT);
Bagherpour-Kashani, Natascha (Archäologisches Museum Frankfurt, Frankfurt am Main, AUT);
Boenke, Nicole (Ruhr-Universität Bochum, Bochum, GER);
Stöllner, Thomas (Ruhr-Universität Bochum, Bochum, GER)

The application of natural sciences in archaeological research has been becoming more and more important in the last decades. Methodological issues as well as their relationship and boundaries of different research fields are still in movement. This study uses the landscape reconstruction around the salt mine at Chehrabad (Province Zanjan, Iran) as an example.

Since 1994 the remains of more than five men have been discovered in the Chehrabad salt mine that was active during Achaemenid (6th-4th cent. BCE), Sasanian (4th-6th cent. CE) and up to 2008 CE. Some of these salt mummies are extremely well preserved and together with abundant other organic remains enable exceptional insights into various aspects of past mining activity (http://www.saltmen-iran.com).

Chehrabad is located in the Mahneshan Range in the northwestern Iranian Plateau at an altitude of ca. 1450 m. Geologically the area belongs to the Central Iran tectonic unit and is characterized by folded and thrusted colorful Miocene marl and sandstone, with occurrences of gypsum and salt. These deformed sediments are discordantly overlain by a thin layer of terrestrial Quaternary, up to boulder sized sediments forming a prominent regional flat surface. The present landscape is mainly the result of late Pleistocene to Holocene dissection of above mentioned successions and modern valley fill. During a trenching campaign in 2011, alluvial sediments were exposed up to 5 m depth with preliminary calibrated radiocarbon ages of organic matter indicating sedimentation rates of c. 2-7 mm/a.

In 2016, during a geoarchaeological investigation five < 10 m deep cores have been taken by geotechnical rotary drilling and the sediments documented and sampled in detail. Preliminary results show that the core sediments are dominated by fine to very fine grained sediments, with only marginal gravel layers, which is surprising considering the generally coarse grain-sizes of the present rivers. Additionally, the considerable sedimentation rates from the 2011 investigations are at odd with the observation that virtually all of the rivers in the study area obviously show erosive behavior at present, with their channels being located more than 2 m below the level of the valley fill in some places.

Both observations are difficult to explain by purely fluvial processes and/or base level changes, e.g. by tectonic movements. Therefore it was decided to use an ethnogeoarchaeological approach, including interviews of local residents, for additional aspects. Field surveys and high-resolution digital terrain (DTM) data, calculated by structure-from-motion (SFM) from drone aerial photography showed that virtually the whole valley floor is shaped by inconspicuous field terraces. Additionally, all terraced fields show numerous irrigation channels whose upstream parts are connected with river beds, where the irrigation channels have a considerable lower gradient than the rivers. In this way, water can be transported up to the field levels without any additional support, partly > 2 m above the river, just defined by the length and gradient of the irrigation channel. As the drainage channels only transport fine-grained sediments, only those are deposited on the fields. Fluvial erosion of fields is prevented by stone walls; thus river channels are fixed to their location and hardly are able flooding fields. Both mechanisms contribute to the dominance of fine grain-sizes and scarcity of gravel documented in the cores.