SEDIMENTOLOGIC AND GEOMORPHOLOGIC ANALYSIS OF THE EVOLUTION OF ALLUVIAL FANS IN THE SOUTHERN DEATH VALLEY, CALIFORNIA (SW-USA)

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Alluvial fans are amongst the most complex and less understood continental depositional environments. Little is known about the evolution stages acting through time, undergoing changing external conditions. The aim of this study is to gain new insights into the three-dimensional composition of alluvial fan deposits. Special attention was paid to the depositional processes and the corresponding architectural elements. Changing evolutionary stages (aggradation, pro- or retrogradation) have been interpreted according to the concept of the morphometric base-level.

The study was carried out on four alluvial fans (Anvil Spring Canyon Fan, Warm Spring Canyon Fan, Hanaupah Canyon Fan & Trail Canyon Fan) along the eastside of the Panamint Range in the southern Death Valley National Park. Deeply incised channels made them ideal for sedimentological outcrop studies. The study combines sedimentological work at cut-faces of the incised channels with detailed geomorphologic surface-mapping, supported by remote sensing data. At the cut-faces 1D lithological profiles have been combined with 2D photo mosaics to transfer the lithological information to a quantitative analysis of architectural elements. These elements consist of at least one lithofacies type and are themselves genetically bound to higher-order depositional systems such as braided-fluvial systems or mass flow events. The aim of this analysis was to figure out the change of predominant sedimentary processes. Deciphering the change of sediment supply and accommodation space on alluvial fan deposits we also focused on erosional features (including reworking surfaces and the change of the width/depth distribution of scour pools) and aggradational elements (e.g. longitudinal bars or spill-overs). Comparing the change of base-level between the different alluvial fans allowed us to discern an overall signal of alluvial fan evolution.

Remote sensing data (Landsat 7 ETM+) have been merged with USGS ortho-quadrangle aerial photographs to create high resolution aerial maps. Enhanced by GPS-based geomorphological surface-mapping, it was possible to identify several prominent surfaces as well as neotectonic movements, displayed in normal faults and strike-slip features. These surfaces, differing in relative age, were distinguished by their stage of soil development (Calcretes), development of desert varnish and desert pavement, their preservation potential of former incisions and their neotectonic setting.

These approaches have been summarized to a comprehensive model, identifying the return frequencies and magnitudes of the most important formative processes like debris flows and or braided-fluvial systems.