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Deciphepring the grain-size trends through time: case study of the quaternary Urumqi alluvial in the Chinese Tian Shan piedmont

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Understanding the controls on the size of the sediments observed in sedimentary basins is a key challenge in sedimentology, as it influences strongly the physical processes of transport and deposition, and thus the characteristics of basin filings. In addition, the size of the sediments is related to the conditions prevailing in the area where they have been produced, and we should theoretically be able to read the tectonic and climatic conditions that prevailed at the time of deposition from the granulometric evolution of the sediments coming from a given area. If large changes in the granulometry of the sediments are often associated to climatic or tectonic perturbations, the influence of autogenic processes, and in particular of autogenic incisions of alluvial deposits, should also be considered.

To bring insight into this question, we sampled the grain size along a well-exposed, vertical section of an alluvial fan mainly made up of gravels, and located in the semi-arid northern piedmont of the Tian Shan in China. Alluvial fans are well designed to explore such questions, as they are located at the outlet of drainage basins and constitute therefore the first record of the sediments exported out of the relief. Datations based on cosmogenic and OSL analyses provide a good temporal framework, and allow the comparison with the documented climatic or tectonic events that have affected the area.

Based on these data, we discuss the possible relationships between the observed evolution in grain size for the last 300 000 years and the known history of the studied fluvial system. We propose that the granulometric signal is related initially to the growth of the alluvial fan, and then, to its incision due to the last glacial-interglacial climatic change. However, autogenic events might also have been recorded and in particular, a recent and short-lived increase of the average grain size could be related to the rapid incision of the river, which could have enhanced the transport capacity and thus, enabled the river to carry large grains further into the sedimentary system.