Experimental luminescence dating of Quaternary river terraces, High Atlas Mountains, Morocco

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Project summary

An ongoing research challenge is to understand how and when changes in climate cause river strath terrace formation. To explore the interplay of Quaternary Saharan climate and low uplift rate tectonics at the edge of the African craton, I applied luminescence dating to samples of terrace sediment from the Atlas Mountains. However, coarse fluvial sediments regularly found in river terrace in high relief landscapes complicate the calculation of dose rates, one vital part of OSL dating, and have until recently been outside the scope of conventional OSL approaches. Thanks to the additional support from the BSG I was able sample additional material to work on new approaches to determining dose rates in coarse-grained river terrace conglomerates and to contribute to an experimental method of bedrock exposure to unlock new insights into river terrace formation processes and their record of climate and tectonic history.

Results

Preliminary results reveal that the most recent terrace strath planation in a 1200 km river catchment, the River M'Goun, started at ~180 ka in the MIS 6 glacial maximum, followed by aggradation from 140 – 57 ka in MIS 5 to MIS 4 which deposited the up to 10 m stratigraphy of fluvial conglomerate (imbricated rounded cobbles). Incision and abandonment of river terraces occur in MIS 3 to 2 during the transition to the last glacial maximum. Our results compared with an Atlantic record of aridity in the Northern Sahara over the last 120 ka show that aggradation and valley widening occur in response to periods of northward penetration of the African summer monsoon into the High Atlas. In addition, data collected on rock dating contribute to a feasibility study of dating rocks using Luminescence on surface slices.

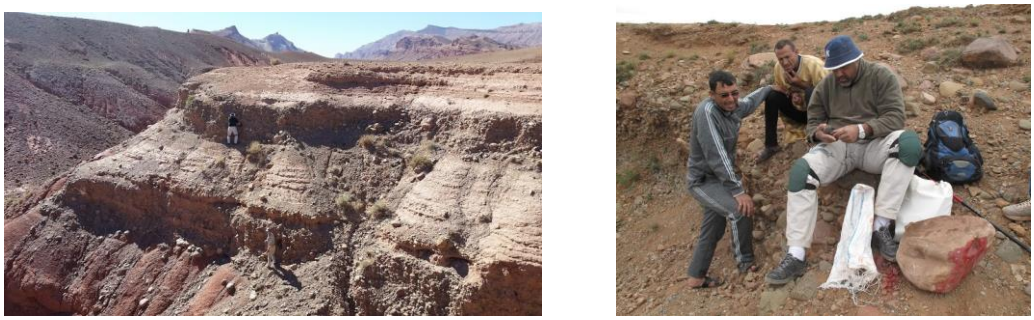

Figure 1 – collection of samples in river terraces, conglomerates and sand (left) and rock samples (right)

Outcome

Preliminary terrace dates were presented at INQUA 2019 with BSG acknowledgement. Revealed patterns of aggradation and incision in response to penetration of the Saharan summer monsoon over the last 180 ka will be presented at the AGU Fall meeting in December. A manuscript is in preparation.

Summary

Innovative luminescence dating reveals patterns of glacial-interglacial aggradation and incision of North-West African strath terraces in response to Quaternary changes in Saharan climate.