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Controls on pebbles size and shape in streams of the Swiss Alps

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Rivers in the Swiss Alps have been analyzed to determine the relationships between fluvial processes and grain size and shape to emphasize the factors controlling the grain characteristics. 18 bars of gravel-bed rivers have been sampled. At each site the long axis and the intermediate axis of about 500 pebbles have been measured. In addition the morphometric properties of each river basin have been studied.
Looking for correlation between grain size and shape and other fluvial properties the study shows that grain size and shape are mainly controlled by the lithology on which the rivers are mainly flowing and by the supply of material through mass failure processes. Deposits of rivers flowing on sedimentary lithology are better sorted and the pebbles are more rounds and have smoother surface than the deposits of rivers flowing on metamorphic lithology. The percentage of hillslopes angles ranging between 20 and 30° correlate with the coarser fraction of the pebbles in all the studied streams. These hillslopes angles ranging between 20 and 30° reflect threshold conditions for failure and so it appeared that mass failure processes along the streams impact the grain size population through the supply of coarse grained material.
However, no correlations have been found between grain size and shape and erosion rate, hydrological conditions or basins metric properties. The lack of correlation between grain size and shape and the water discharge is mainly explained by the fact that the streams of the Swiss Alps are in a supply limited state.
Remarkably for all these different pebbles size and river/basin properties, the ratio of the intermediate axis and the long axis only ranges between 0.63 and 0.72 without any relationships with the lithology. This ratio named the elongation E is not impacted by any of the analyzed river processes in the studied rivers. Pebbles' size and shape reflect the sediment dynamics and can be used to explore the controls of river processes on riverbed properties