

Bridging scales from satellite to grains: Structural mapping aided by tablet and photogrammetry

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A fundamental problem in small-scale mapping is linking outcrop observations to the large scale deformation pattern. The evolution of handheld devices such as tablets with integrated GPS and the availability of airborne imagery allows a precise localization of outcrops. Detailed structural geometries can be analyzed through ortho-rectified photo mosaics generated by photogrammetry software.

In this study, we use a cheap standard Samsung-tablet (< 300 Euro) to map individual, up to 60 m long shear zones with the tracking option offered by the program Locus Map. Even though GPS accuracy is about 3 m, the relative error from one point to another during tracking is on the order of only about 1 dm.

Parts of the shear zone with excellent outcrop are photographed with a standard camera with a relatively wide angle in a mosaic array. An area of about 30 sqm needs about 50 photographs with enough overlap to be used for photogrammetry. The software PhotoScan from Agisoft matches the photographs in a fully automated manner, calculates a 3D model of the outcrop, and has the option to project this as an orthophoto onto a flat surface. This allows original orientations of grain-scale structures to be recorded over areas on a scale up to tens to hundreds of metres.

The photo mosaics can then be georeferenced with the aid of the GPS-tracks of the shear zones and included in a GIS. This provides a cheap recording of the structures in high detail. The great advantages over mapping with UAVs (drones) is the resolution (<1mm to >1cm), the independence from weather and energy source, and the low cost.