

## **Geochemical characterization of the Giv'at Kipod extraction site (Israel): A basis for provenance analyses of Neolithic-Chalcolithic rock tools in the southern Levant**

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The Late Neolithic-Chalcolithic basanite extraction site of the Giv'at Kipod (Yizrael Valley) is the first quarry for basaltic rock tools known in the region south of the Turkish part of Thrace. It serves as the ideal case study because it provides for the first time the possibility for a raw material centred provenance study in the region.

Giv'at Kipod is a quarry for bifacial tools (axes) including a major production area where bifacials were knapped, with large accumulations of debitage and bifacial roughouts. The well accessible Giv'at Kipod is a deposit of a "top quality" raw material: The basaltic rock is very compact and fine-grained, allowing excellent control during the knapping process. Due to the mass of production waste a considerable amount of tools must have been produced and exported from the site. However, so far we have scant information concerning target-sites or trade routes. This raises important issues regarding the extent and organization of the production and the distribution of the products in the southern Levant.

To determine the provenance of an artefact the exact characterization of the potential deposits is crucial. So the geochemical-mineralogical variability of the Giv'at Kipod basanite-deposit had to be defined and distinguished from other comparable basaltic deposits in the region. For this purpose, in addition to Giv'at Kipod, outcrops from all Miocene basaltic rocks in and close to the Yizrael Valley were sampled. Whole rock major and trace element compositions were determined by XRF and supplemented by LA-ICP-MS and EPMA measurements.

The results showed that the Giv'at Kipod extraction site can be geochemically well discriminated from all other Miocene basaltic rocks in the Yizrael Valley. So the potential provenance of a tool from Giv'at Kipod can be reliably confirmed or rejected.

Subsequently basaltic rock tools from seven archaeological sites (dated from Pre-pottery Neolithic through Early Chalcolithic) were sampled. Because of the small amount of sample material from every tool the major element composition was determined by XRF, the trace element composition exclusively by Laser-ICP-MS. The evaluation of the artefact data and the comparison to the geological field data showed that two-dimensional element comparisons give ambiguous results. So cluster analyses were applied to reveal on a neutral, multivariate basis if a tool can be affiliated to Giv'at Kipod or if it can be linked to any of the other analyzed basaltic rocks.

The results show that only for few items a Giv'at Kipod provenance can be proven. So far only one settlement in close vicinity to Giv'at Kipod clearly obtained tools from this extraction site. This astonishing result raises the question: Where did all the products go? We still are at the very beginning: More tools have to be sampled to get an idea of the extent of production and export from Giv'at Kipod. Nonetheless, this study has great impact on future provenance studies in the region, because it has shown that on the basis of intensive field sampling the basaltic deposits can be very well constrained even on a small scale.