A unaltered paleosurface (regolith) preserved since Oligocene times on top of the Sesia Zone, Western Italian Alps

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A paleosurface (regolith) occurs on top of the high-pressure metamorphic rocks of the Sesia-Lanzo Zone in the Biella region. The regolith is mostly covered by epiclastic rocks frequently containing non-volcanic detritus mainly coming from the gneisses of the Sesia-Lanzo Zone. The depositional facies of the epiclastite is alluvial. A precise radiometric U/Pb-zircon age of 32.65±0.24 Ma (early Oligocene) obtained for the volcanic rocks gives a minimum age for the exhumation at the surface of this portion of the HP-gneisses of the Sesia-Lanzo Zone.

The transition between the eclogitic gneisses of the Sesia Zone and the regolith is preserved in its original state without any later tectonic overprint. The same is also true for the transition between the regolith and the volcanic suite. Apart from in Passobreve (Valle del Cervo) and Bocchetta di Sessera, where the contact between the regolith and the volcanic rocks is affected by late cataclastic faults, the outcrops indicate an unaltered surface sequence from the Sesia gneisses through the regolith up to the overlaying volcanic and volcanoclastic rocks.

The regolith can be described as grain-supported, unsorted, ungraded, monomictic breccia consisting exclusively of angular Sesia gneiss components (several dm to sub-mm in size) incorporated into a fine-grained matrix. The regolith developed through mechanical fracturing of Sesia rocks. The detritic part of the matrix and the angular components reveal weathering structures and only local transport of fragments on a gently inclined slope. The components often indicate that a former single rock has been fragmented and its components are slightly shifted against each other. Epiclastic volcanic rocks with Sesia components cover the regolith. With increasing distance from the contact, the amount of Sesia components decreases. Above these rocks, epiclastic volcanic rocks without Sesia components were deposited.

Density estimations of the regolith and the underlying Sesia rocks indicate the formation of a relative small amount of clay minerals, and thus a short exposure at the surface. These results confirm the field and micro-structural observations, suggesting a development of the regolith mainly through mechanical disintegration of Sesia rocks.

The authigenic mineral assemblages in the regolith matrix and in the altered volcanic rocks indicate a post-emplacement re-crystallisation at temperatures lower than 300°C. The burial of the regolith and the volcanic rocks, causing steepening and re-crystallisation, seems to be of tectonic nature. The preliminary results of the fission track analyses of apatites indicate a complex re-exhumation history of this crustal block in mid Miocene times (20-12 Ma).

Petrographical studies of the paleosurface give first order information about the environmental conditions of an Alps surface in Oligocene times and the evolution of the paleotopography. Additionally, the paleosurface is a clear marker for subsequent tectonic processes affecting this surface; their reconstruction is important for near surface neotectonic studies.