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Unraveling the origin of the loess of the lower ebro river basin

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Loess deposits related to the lower course of the Ebro river occupy about 2,000 km^2, between the border of the Ebro depression and the Móra d'Ebre basin. They are the largest loess area in the Iberian Peninsula. The detailed study of these deposits has been intensified since the first decade of this century and now the first cartography of their spatial distribution is available. In parallel, the mineral composition, texture and physicochemical properties have been studied and the soils developed on them have been described and analyzed (mainly Calcic Haploxerept, Typic Xerorthent, Typic Calcixeroll). The most modern units have been dated with optically stimulated luminescence (OSL) and would have been deposited between 17 and 34 ky in relation to the Last Glacial Maximum and the oldest (few outcrops) would exceed 115 ky.

They form very discontinuous covers with average thicknesses of about 3-4 m, preferably located on the sheltered slopes of the prevailing W-NW winds and subsequently accumulated in the valley bottoms of the network of rivers and tributaries of the Ebro River. Their generally coarse grain size, with the predominance of very fine sand (50-100 µm) followed by the coarse sand fraction (20-50 µm), classifies them as sandy loess, and this feature has been interpreted as an effect of the proximity of the source areas of the particles, which according to the literature would be less than one hundred km.

Their mineral composition reflects a clear dominance of quartz and calcite (plus dolomite) in similar proportions and feldspar, mica and opaques as secondary minerals. In many of the outcrops, gypsum (up to 20%, average: 3.1%) appears as a companion mineral, which is redistributed in the profiles, preferably in the lower half, as gypsum infillings and crystal intergrowths, up to 1 cm size). It also gives a different response regarding magnetic susceptibility.

The direction of the prevailing winds, the arrangement of the outcrops, the coarse texture and the mineral composition are key indications of the proximal origin of the aeolian materials. Among the candidate areas are the alluvial plains of the Ebro river, which at that time would suffer the deflation of the extensive T-2 terrace (about 8-10 km wide and 20-30 m above the current talweg) and the interfluvial areas with Tertiary outcrops containing gypsum. Heavy minerals could serve as tracers of the origin of river sediments and gypsum (non-existent in river sediments) could be used as a marker of sedimentary materials with Oligocene and Miocene gypsum of the Ebro Depression, which is absent in the Móra d'Ebre basin.

Gypsum loess appears frequently and preferentially on the outcrops of the Ebro Depression. However, in the Móra d'Ebre basin they are seldom, which would indicate the isolation and independence between the two units of accumulation of loess by the Catalan Precoastal Range that would act as a first order orographic barrier against clouds with aeolian dust from the Ebro Depression.