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# Cadmium dynamics as a new marker for palaeopedogenesis at desert margins?

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In drylands, the time span and intensity of humid phases are often not sufficient for discernible soil formation, and basic pH-values delay typical processes as the release of iron oxide and clay formation. Thus the identification of palaeosols as markers for more humid phases may fail. Potentially we found a new method to identify traces of past vegetation covers by measuring the Cadmium (Cd) depletion of sediments.

In the Peruvian Andes, at the western flank of the Cordillera Occidental precipitation originates from monsoonal summer rain from the east, and it declines to the west. This results in rapid change from the Puna highland ecosystem in the east to the hyperarid lowland desert environment in the west, related to a rapid reduction of soil forming intensity.

The geochemical composition of loose sediments and soils in the northern Atacama desert around Palpa/southern Peru (14.5˚S) offers appropriate natural field-lab conditions to studying differences in total and mobile cadmium contents. Soils and sediments in the study area are characterised by a very high total Cd content around 3–4 mg/kg. This is derived from widespread volcanic sources. Obviously, well developed soils of the Puna show a depletion of total Cd. The content of an Andosol profile is depleted to 0.4 mg/kg, whereas the unweathered tephra shows a total Cd-content of 3.3 mg/kg. We hypothesize, that the depletion is due to mobilisation by acid root exudates, emitted by vegetation. Under more arid conditions, a similar pattern may be observed in loose, unstratified loess, which shows no visible horizonation and pedogenesis. For comparison, the dithionite-extractable iron oxide content was determined as

well known marker for pedogenesis and correlates very well with the total Cd content.

Our studies suggest, that cadmium depletion indicates initial (palaeo-)pedogenesis and, therefore, even short humid phases in desert margin areas. The preliminary results indicate a causal relationship between loss in total cadmium content and soil formation, triggered by a temporary vegetation cover. This is supported by a very similar pattern in mobile Cadmium distribution, which is stored in root remnants.

Thus Cd dynamics may archive past environmental conditions, associated with initial soil formation as a result of former climate shifts at the desert margin. This may be useful for palaeoclimatic research.