Silicophytoliths and taphonomy in Cenozoic pedostratigraphic sequences of the Pampean Plain, Argentina

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Abstract

ABSTRACT

Grasslands and savannas occupy one forth of the total surface of South America continent, and within it, the Pampean plain region, located in the central area of eastern Argentina, covers an area of 1,200,000 km2. The dominant soils are Mollisolls generally deep, developed from well-drained loessic parental material and characterized by a silty-loam texture. Pampean Plains is one of the most fertile regions of the world. Intense agricultural activities are carried out there and this, in turn, has strongly modified the native plant communities, especially grasslands. Depending on the environmental and pedological conditions, silicophytoliths are affected by diverse taphonomical processes, both in natural and anthropic environments. They can be preserved, dissolved or fragmented, and also be transported by different agents (wind, water, animals and people). Other taphonomical aspects also important to evaluate are the methodologies used in silicophytolith studies, from soil sampling to studies at a submicroscopic level. There are several current methodologies and the work is essentially done at a very detailed resolution level, which could lead to interpretation errors if the environmental or paleoenvironmental context of the study material is unknown or not clearly stated. The study area is located in regional geomorphological units from Pampean Plain, Argentina, and integrated profiles representative of typical pedoestratigraphic sequences were analyzed. Silicophytoliths were analyzed as part of the whole mineralogy of the soil samples and morphologies were described under optical and scanning electron microscopes. The results show high amounts of silicophytoliths which have been affected by various physical and chemical alteration and/or by taphonomic processes of different types and degrees of intensity. The percentage and number of silicophytoliths per gram of soil vary. In superficial horizons (O, A), the percentage ranged between 10-65%, with 11.000.000-30.000.000 phytoliths per gram of soil (n/g.s). In subsuperficial horizons (AC, B, BC) between 2-6% and 1.000.000-5.000.000 silicophytoliths n/g.s were observed. The percentage of silicophytoliths in loessic parent material (C) ranges between 0.4-2%, with 500.000-2.000.000 n/g.s. In paleosols, percentages range between 1-8%, and the number of silicophytoliths per gram of soils were 1.500.000-8.000.000. Silica and silicophytolith

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biomass content per ha of soil varied according C biomass, in the pedostratigraphic Cenozoic sequences from Pampean plains. Our data show that the content of silicophytoliths decreases between 50 and 95% from superficial to subsuperficial soil horizons due to pedological processes. The comprehension of the physico-chemical degradation and transference processes within silicophytolith-plant-soil-environment system is essential in order to evaluate the role of taphonomical processes in the biogeochemical cycle of silicon. Finally, it is proposed that the displacement of native grasslands may be bio-physico-chemically balanced by the introduction of crops, in relation to the silicon cycle, since they are also important silicophytolith producers in the SE Pampean agroecosystems.
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