Geochemical Functioning of Soil Salinity in Northern Mexico

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Introduction. The eruptive material of the Sierra Madre Occidental in the north of Mexico and the sedimentary material of the Mexican Altiplano that replace it topographically, orients the geochemical features of natural waters and soils.

Materials and Methods. After pedological prospection, three sites representing these petrographic and hydrochemical characteristics were studied (Fig.1). They were chosen from propitious situations to maintain a rised water table. Under climatic conditions of aridity and long dry seasons in this area, the water concentration propitiates salinity in soil surface. Analysis of waters and soil salinities were useful to interpretate the soil-geochemical functioning.

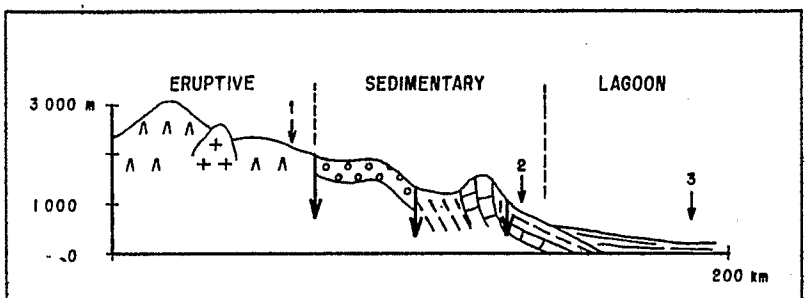

Fig.1. Localization of studied sites.

Results and Discussion. Natural waters of the first site come from a source located in a basaltic material (Chorro, Dgo.); they are sodium bicarbonated waters, as showed on Piper's diagram (2,3) (Fig. 2). Natural waters of the sedimentary site are pumped out from cretacic calcareous and lutite strata (San Jacinto, Dgo.); they are mixed sulphated waters. The third site of this sequence is located in a graben filled up by quaternary alluvions; natural waters come from a run off that goes to an endoreic lagoon (San Pedro, Coah.); they are sodium chloride-sulphated waters (1). Under conditions of a good surface draining, the three different waters run off toward this lagoon where they will be accumulated and concentrated. Along with this sequence, and locally, there are little endoreic bassins with a poor draining condition and a rised water table. In these conditions, there are differentiation of soil salinity profiles with higer concentration of salts in the soil surface.

The following pedological and mineralogical characteristics were identified :

Eruptive site, sodium carbonated Solontchak (pH 9 to 10) with white superficial efflorescences of

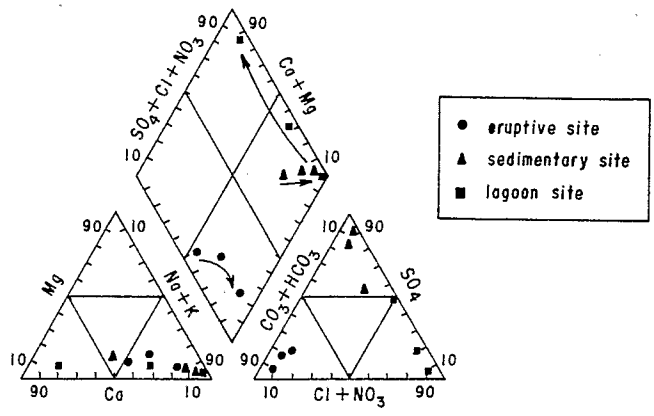

Fig.2 Aqueous solutions on Piper's diagram.

Thermonatrite; when temporarily submerged, it could be distinguish a discontinuous black salting caused by dissolution of the soil organic matter.

Sedimentary site, sodium sulphated Solontchak (pH 8 to 8.4) with white powdered salinity of Thenardite.

Lagoon site, sodium chlorided Solontchak (pH 7 to 8) with dusty signs of Halite and locally hygroscopical salting signs (calcium chloride).

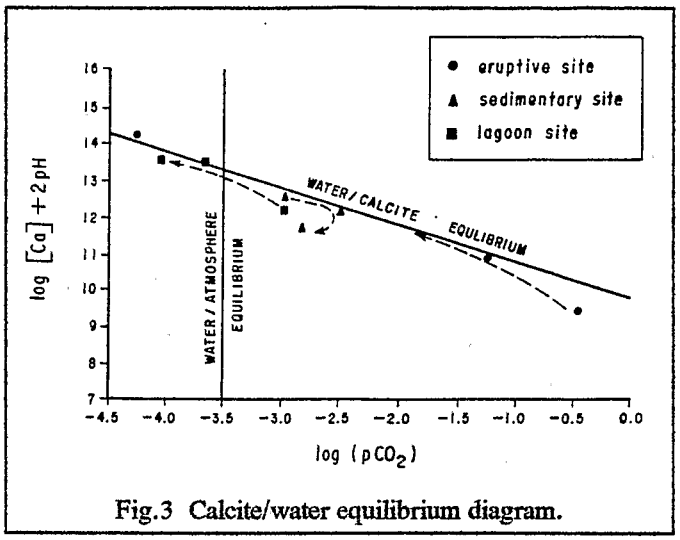

Fig.3 Calcite/water equilibrium diagram.

Besides the superficial evaporitical salts, the analysis of vertical salinity sections shows, according with each site, less soluble mineral paragenesis precipited within the soil. In all the sites, the abundance of limestone is in agreement with the state of saturation of soil solutions related to calcite (Fig 3).

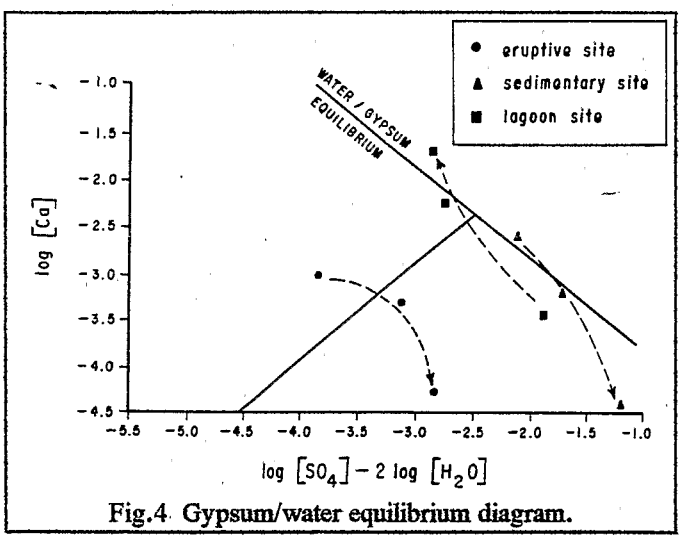

Fig.4 Gypsum/water equilibrium diagram.

This is also according to predictions of the thermodynamical evaporative model "SOPREX" (4). Moreover, the state of saturation related to gypsum are diferent for each site (Fig. 4). Neverthless, geochemical criteria of residual alcalinity after calcite precipitation (5) shows an always positive value for waters and soil solutions of the eruptive site, and an always negative value for those of the sedimentary and lagoon sites.

Thus, we can separate two main ways of geochemical evolution in soils when natural waters are concentred in contact with geopedological materials: the alcaline way for the sodium carbonated Solontchak, and the neutral way for the sodium sulphated and sodium chlorided Solontchaks.

Literature Cited.

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