

# THE CALICHE CORDÃO OF THE SOUTHERN COASTAL PLAIN OF RIO GRANDE DO SUL, BRAZIL

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Here is presented a detailed description of the caliche deposits found in the Southern coastal plain of Rio Grande do Sul state (CPRS), Brazil. Designed as Caliche Cordão in the 1960s, these deposits occur in subsurface, mostly in lowland depressions (lagoon systems) located between the coastal sandy barrier systems, but are rare and sparsely distributed on the coastal barriers. The best outcrops with caliche are visible along the banks of Chuí Creek, gullies and lake banks. The caliche found along Chuí Creek is characterized by two horizons that stretch continuously for more than 400 meters: the lower one, found within the paleosoils and fluvial deposits of the Santa Vitória Formation (SVF), consists of vertical rhizoliths formed by carbonate precipitated around plant roots. The upper one consists of subspherical, centimetric nodules found in the lower half of a loess layer that overlies the SVF. Larger, subhorizontal masses of nodules are formed by coalescence of the smaller ones. Petrographic analysis shows that the caliche from both horizons is formed by a matrix of dense micritic cement (Alpha-type) precipitated around grains of quartz and feldspar, which are larger in samples from the lower horizon. Larger crystals of bladed calcite are found around several quartz and feldspar grains, and partially filling crackings and voids in the matrix. Cracked quartz and feldspar grains occur in some samples, and probably result from the growth of displacive calcite. These features suggest that the caliche is of pedogenic origin, abiotically precipitated in the vadose zone, and was not subject to significant diagenesis. The sediments in the southern CPRS are essentially siliciclastic, and the carbonate could have been supplied either by weathering of feldspars or by aeolian input, therefore the caliche is a secondary carbonate. The caliche found in the barriers and lake banks are similar, but one nodule from the Pleistocene Barrier III also exhibits micrite-filled root tubules. One sample from the eastern bank of Mirim Lake (Lagoon System II) exhibits larger sparry grains, which suggests recrystallization. Isotopic values of oxygen ( $\delta^{18}\text{O}_{\text{PDB}}$ ) in samples from the lower horizon varied between -1.99‰ and -2.59‰, and carbon ( $\delta^{13}\text{C}_{\text{PDB}}$ ) values ranged between -8.61‰ and -7.71‰. In the upper horizon,  $\delta^{18}\text{O}_{\text{PDB}}$  varied from -1.81‰ to -3.44‰, and  $\delta^{13}\text{C}_{\text{PDB}}$  from -9.05‰ to -5.5‰. The  $\delta^{18}\text{O}$  values suggest temperatures of  $\sim 21^\circ\text{C}$  and high rainfall ( $>100$  mm) during caliche formation, by comparison with the present-day relationship between the isotopic values and amount of precipitation in Rio Grande do Sul (Porto Alegre). The  $\delta^{13}\text{C}$  values indicate the presence of C3 and C4 plants. The formation of pedogenic caliche deposits is related to contrasting seasonal (dry-wet) conditions with total mean annual rainfall  $\leq 500$  mm, and the two horizons found along Chuí Creek suggest two phases of caliche formation in the CPRS, possibly during distinct glacial epochs. Such material is not found in the central and northern sectors of the CPRS, and its distribution matches that of the loess deposits, therefore the latter could have been the parent material for the caliche.

**PALAVRAS-CHAVE:** CALICHE; PALEOCLIMA; PLANÍCIE COSTEIRA