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Origin and Significance of Concreted Paleosols in Onshore-Offshore Deposits

Paleosol identification is important for recognizing sea-level fluctuations in the rock record, characterizing distinct hydrogeologic systems and evaluating unique physical properties within sediments. Discrete cemented intervals ranging from several centimeters to meters in thickness occur within Pleistocene and Tertiary coastal plain deposits from the north to south Atlantic. Each cemented zone is characterized as a paleosol that formed by desilication processes associated with vegetative stabilization. In offshore areas, paleosols represent lithification within coastal systems during major regressive episodes. They are recognized at the seabed surface as normally-consolidated to overconsolidated hardgrounds and within the subsurface by strong acoustic reflectors and highly-lithified strata.

Uppermost sands were stabilized by vegetation and subjected to meteoric leaching. Humic acids contributed to the dissociation of mobile cations that became concentrated in the underlying sands as less-stable diagenetic minerals. These sands are enriched in kaolinitic clays.

Iron oxides and oxyhydroxides form dominant cements in the middle zone. They form from precursor species and can have intragranular pore spaces up to 40% greater than the original mineral. The lowermost sediments existed within the saturated zone and retain most of their original signatures. Immature to supermature quartz lepispheres may form at the contact between units 2 and 3 through dissolution of biogenic silica and supersaturation of opal-CT at the top of the phreatic zone.

Thickness of the paleosols is controlled by : 1) spatial and temporal variability of the vadose zone; 2) depth to the phreatic zone; 3) depositional texture and mineralogy; and 4) the presence and extent of vegetation.