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Controls on the Development of Dissolution-Collapse Features in Lower Cretaceous Carbonate Platform Strata, DeSoto Canyon Area, Offshore Alabama-Florida

Lower Cretaceous carbonate platform strata from the central DeSoto Canyon area, offshore Alabama and Florida contain major dissolution-collapse features. These features were mapped across the study area using a tight 2-D seismic grid. The dissolution-collapse zones are crudely rectilinear in plan view; more elongated dissolution features are oriented subparallel to regional dip on the Lower Cretaceous platform. The most intense dissolution developed near the erosional margin that defines the seaward limit of the Lower Cretaceous platform. Middle Cretaceous to lower Oligocene strata above the apparent dissolution features are cut by numerous collapse-related faults. Vertical offsets on these faults appear similar throughout the overlying Middle Cretaceous to lower Oligocene interval, which suggests that the deformation occurred from the onset of the middle Oligocene unconformity into Recent time. Bi-directional stratal onlap within the collapse features is largely restricted to strata above the middle Oligocene unconformity. The onlapping strata and fault-timing relationships suggest that the collapse zones in Lower Cretaceous strata propagated upward and created seafloor topography (i.e., submarine sinkholes) during middle Oligocene through Recent time. Dissolution and collapse probably occurred when a regional confined freshwater aquifer system developed within the Lower Cretaceous interval during middle Oligocene time. Meteoric groundwater likely flowed from northern recharge areas in central Alabama and discharged along the western erosional escarpment of the Lower Cretaceous platform. Meteoric groundwater probably mixed either with seawater that infiltrated the platform along the escarpment or with basinal fluids that had migrated to structurally high areas where the dissolution-collapse zones are most prominent. The spatial and temporal coincidence of several factors allowed the dissolution-collapse features to form, including focusing of fluid flow to a pre-existing high (the Southern Platform), the absence of onlapping Tertiary strata along the platform's escarpment margin, and the hydrogeological evolution of the Southeastern Coastal Plain Aquifer System.