The majority of carbonate concretions of the Rhinestreet shale are found in three stratigraphically confined but laterally persistent horizons (see lithologic log). Most concretions are oblate ellipsoids with maximum diameters and thicknesses ranging up to 2.7 m and 1.1 m, respectively. Field observations, including randomly tilted concretions and differential compaction of host sediment laminae around concretions, are consistent with early diagenetic growth in unconsolidated sediment. Further, estimates of pre-cementation host sediment porosity based on the volume percentage of calcium carbonate cement (74 to 93%) and, perhaps most importantly, the preservation of a cardhouse clay fabric observed within concretion samples studied with the scanning electron microscope, suggest that concretionary growth occurred rapidly within perhaps a meter of the seafloor (Lash and Blood, 2004a,b).

Concretions offer a unique opportunity to quantify the effects of gravitational compaction of the Rhinestreet shale. However, to ensure that our calculations yield finite compaction strain of the host shale, we must be certain that the Rhinestreet concretions formed rapidly and, most importantly, close to the sediment-water interface. Field observations, including the wrapping of shale around concretions and the lack of center-to-edge deviation in laminae thickness, demonstrate that concretions formed rapidly at shallow depth, perhaps a meter or so below the seafloor (Lash and Blood, 2004a, b). Lash & Blood (2004a) maintain that Rhinestreet concretions formed by the passive infilling of host sediment porosity by carbonate cement (e.g., Raiswell & Fisher, 2000). Accordingly, the volume percent of carbonate cement in the concretion matrix is a proxy for the porosity of the host sediment at the time of concretion growth (Raiswell 1971; Gautier, 1982). Volume percent of 21 Rhinestreet concretion samples collected from four concretions varies from 74 to 93% (mean = 83%), a range that encompasses the high end of porosity of modern marine clay deposits close to or at the water-sediment interface (e.g., Müller, 1967; Valde, 1996) further suggesting a very shallow depth of origin.