Depositional Environments of the Catahoula Formation, Walker County, Texas

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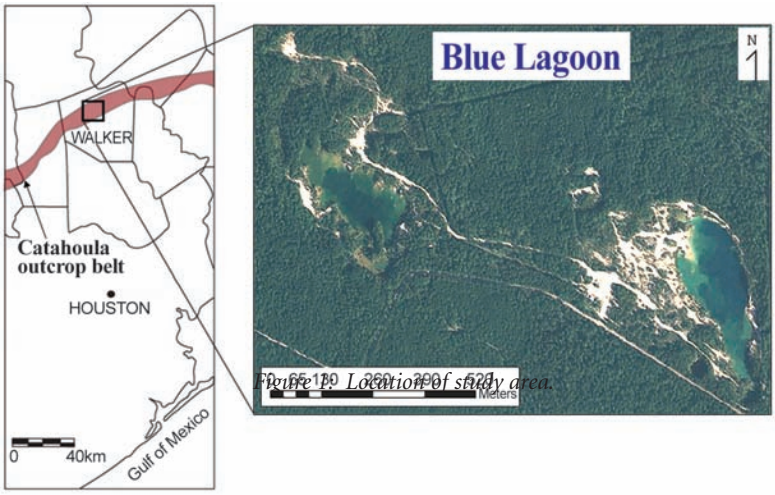

Figure 1: Location of study area.

Fluvial sedimentary rocks of the Oligocene–Lower Miocene Catahoula Formation were studied where they outcrop at a flooded rock quarry in Walker County, Texas. The study area, known as the Blue Lagoon, is located about 70 miles (110 km) north of Houston in northwest Huntsville (Fig. 1). Outcrops are exposed mainly along the banks of the artificial lagoon, providing a three-dimensional perspective of the laterally extensive strata. The exceptional exposures in the abandoned quarry are unusual for coastal plain sedimentary rocks and afford an excellent opportunity to apply recent work on fluvial architecture to this unit.

Stratigraphic sections were measured to determine lithofacies, sedimentary structures and paleoflow patterns. Photomosaics were constructed to show the geometry and spatial distributions of depositional elements (Fig. 2). Lithofacies identified within the multistory channel bodies include basal channel-fill, barform, overbank, abandoned channel-fill and interchannel deposits. Barforms aggraded by downstream and lateral accretion contain a variety of sedimentary structures, including trough and tabular cross-stratification, planar stratification and ripple-drift lamination. Soft-sediment deformation is locally present due to rapid loading of sands over claystone.

Vertically stacked channel-fill units consist of opal and/or quartz-cemented, medium- to very coarse-grained quartzarenite. Differential cementation of opal versus quartz occurs at different stratigraphic levels within the channels. This is probably due to alteration of opal to quartz in response to burial diagenesis and/or the groundwater activity. Silicified wood fragments and well-preserved fossil flora are common at the bases of the channel-fills (Fig. 3). Sediments deposited mainly from suspension during low-flow conditions (e.g., abandoned channel-fill, overbank deposits) contain abundant oxidized plant fragments. Detrital clay was deposited in interchannel areas, at the bases of channel storys and, in places, alternating with interbeds of sandstone. Post-depositional clay occurs as cutans coating the grains and as clay matrix within quartzarenite.

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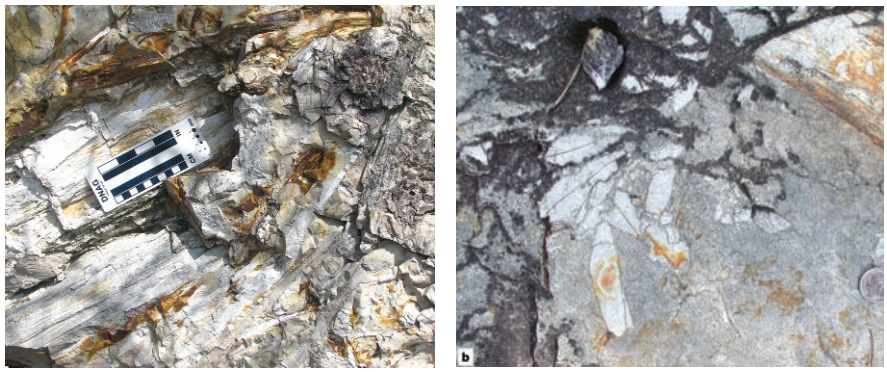

Figure 3: Well-preserved silicified logs (a) are preserved at the base of channel whereas plant fossils (b) are common in sediments deposited during low flow conditions.

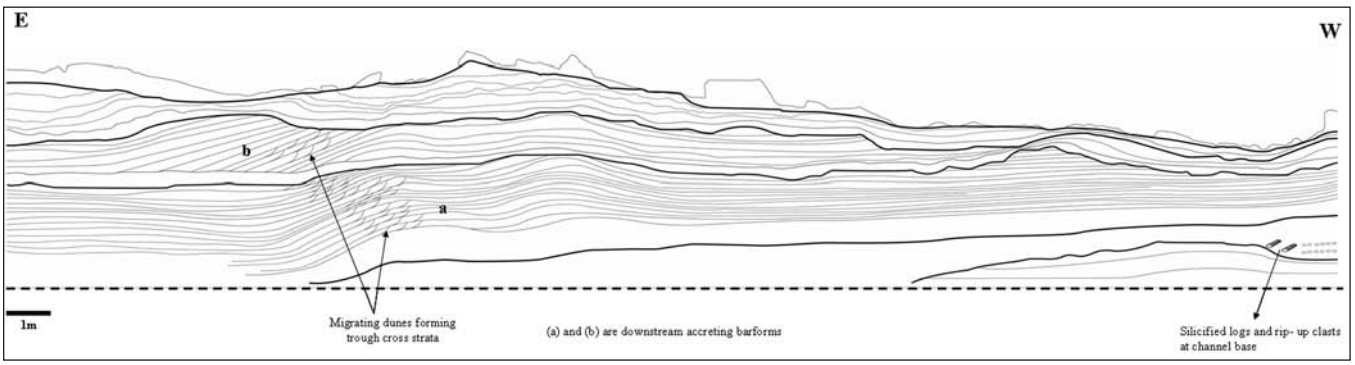

Figure 2: Cross section view from photomosiac showing vertically stacked multistory channel fill. The bases of the channels are represented by thick black lines.

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The clay is mainly smectite (allophane?), probably altered from reworked volcanic ash deposited in the drainage areas of the fluvial system. Alteration of volcanic ash to smectite was the result of pedogenesis and/or shallow burial diagenesis. This caused the release of silica into the pore fluids and subsequent precipitation of opal that acts as the cement for the quartzarenite.

Figure 4: Cross section showing curved vertically stacked channel storys. The base of individual channels is marked in solid lines. Fault planes are marked in black dashed lines whereas arrows represent zones of intense jointing.

Structural deformation is evidenced by extensive jointing, tilted strata and locally exposed normal faults (Figs. 4 and 5). It appears that the mined-out portion of the quarry was a NNW-trending graben in which the quartzarenite was preferentially quarried. The faults do not appear to be syndepositional, and near-surface or shallow subsurface growth faults are virtually absent in this region.

Figure 5: Cross section of a NNW-trending normal fault showing juxtaposed sandstone against underlying clay deposit.

Thus, Tertiary salt tectonism may be the most likely mechanism for the deformation.

The fluvial depositional elements and paleocurrent analysis indicate deposition within a single-thread meandering river system (Fig. 6). Paleocurrent analyses of cross strata record a somewhat variable paleoflow to the southeast and southwest due to lateral migration of the fluvial channel. Abandoned channel facies indicate avulsion of the fluvial system. Future work will include petrographic studies to determine mineralogy and to better understand the diagenetic history of the unit. ■

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Biographical Sketch

Ugo Odumah received her Bachelors degree in geology from Obafemi Awolowo University, Ile-Ife, Nigeria. She is currently in the master's program in geology at the University of Houston, Texas, and expected to graduate in 2008. Her geological interests are in sedimentology and stratigraphy with particular interests in fluvial, deltaic and deepwater depositional systems. Ms. Odumah was the tier 1 winner for new graduate students at the poster competition at the Sheriff Lecture in November 2007.

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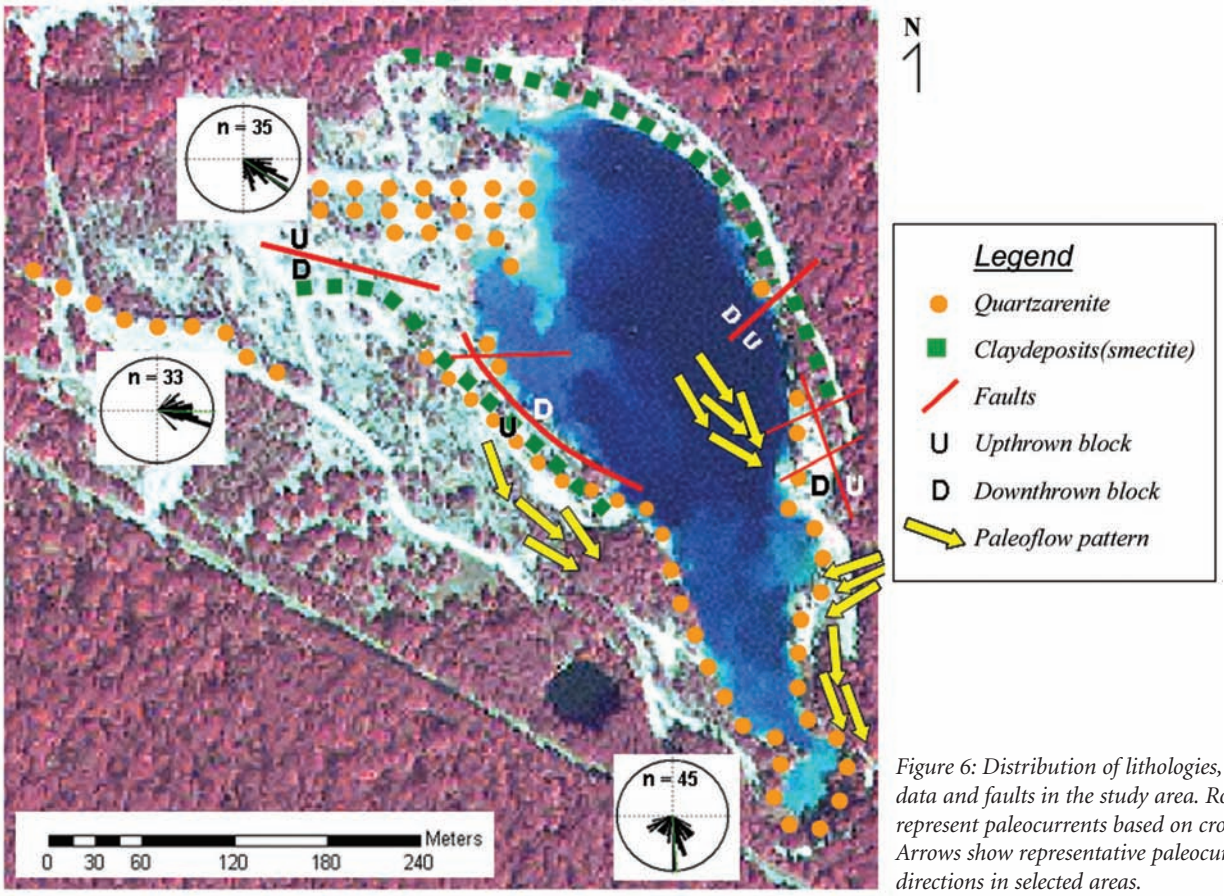

Figure 6: Distribution of lithologies, paleocurrent data and faults in the study area. Rose diagrams represent paleocurrents based on cross strata. Arrows show representative paleocurrent directions in selected areas.