Integrated Stratigraphy of the Austin Chalk Group across the San Marcos Arch, Bexar County, Texas

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EXTENDED ABSTRACT

The Cretaceous Period was punctuated by a series of perturbations of the global carbon cycle that culminated in the installation of oceanic anoxia and affected marine ecosystems (Schlanger and Jenkyns, 1976; Weissert et al., 1998; Erba, 2004; Weissert and Erba, 2004). One of these oceanic anoxic events (OAE), the OAE3, developed during the Coniacian to early Campanian time period and lasted for almost 5 Myr, although its extent is regional compared to other OAEs, such as the OAE2 at the Cenomanian -Turonian boundary (Wagner et al., 2004; Locklair et al., 2011; Wagreich, 2012). The OAE3 is depicted by a series of 5 short-amplitude, high-frequency positive peaks in the evolution of carbon stable isotope (δ 13C; Wagreich, 2009). During this part of the Late Cretaceous, the epicontinental Western Interior Seaway covered central Texas, resulting in the deposition of a thick series of fine-grained carbonate sediments known as the Austin Chalk. Despite a relatively well-constrained biostratigraphic framework (e.g., Young, 1963; Pessagno, 1969; Jiang, 1989; Lundquist, 2000), the Austin Chalk lacks a robust integrated stratigraphic framework in which the impact of the aforementioned paleoenvironmental crisis as well as more local parameters (e.g., local submarine topography, nutrient and detrital input) on carbonate bio- and lithofacies could be assessed.

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Integrated Stratigraphy of the Austin Chalk Group across the San Marcos Arch, South-Central Texas John Cooper, Jeffrey Hardwick, and Alexis Godet Department of Geological Sciences, University of Texas at San Antonio, Texas 78249

Objectives

- Build a sequence stratigraphic framework of the Austin Chalk across the San Marcos Arch by integrating outcrop and subsurface data
- Identify regional changes in thickness and facies by comparing gamma ray log response between outcrop and subsurface data while integrating litho- and sequence stratigraphic relationships observed in outcrop

Background

- The Austin Chalk Group thins from the type section in Travis County over the San Marcos Arch
- Several intraformational discontinuities within the Austin Chalk, most commonly recognized as bored hardgrounds, contribute to subtle truncation of stratigraphic units in south-central Texas and have regional correlative potential from outcrop to subsurface





Stratigraphic Columns



Chalky Siltston

2 Wurzbach Parkway @ Salado Creek

- 3 Lady Bird Johnson Park @ Salado Creek
- ④ Longhorn Quarry ⑤ Cibolo Creek

Austin Chalk outcrop trend



(Durham, 1991)

The Burditt and Pflugerville formations pinchout to the southwest over the San Marcos Arch and an overall thinning of each formation within the Austin Chalk Group is observed. The Jonah Grainstone also appears to thin across the San Marcos Arch and eventually pinches out entirely into Bexar County further southwest.



Microphotographs A-J (below) referenced by location on measured sections

Longhorn Quarry

Chalk on the Geologic Atlas of Texas as defined by Ellisor and Teagle (1934).



Echinoderm Wackestone E. Echinoderm Fragment

Microfacies



Fossiliferous Chalky Siltstone

Skeletal Wackestone-Packstone Ov. Ovster

Ovster-Foraminiferal Wackestor

Oy, Oyster; Fo, Foraminifera

Well Log Location Map



Subsurface Correlation Variations between depositional geometries of the Lower, Middle, & Upper Austin



Supplemental Outcrops





Above) Roadcut at Hildebrand & 281, Bexar County. The contact (AM1) between the soft, argillaceous chalk of the Lower Atco with the more resistant limestones of the Upper Atco above is sharp and marked by a well-developed marl seam that shows a good gamma ray spike

(1893).

(Above) Olympia Hills Golf

(Left) Cibolo Creek, Bexar County. The primary author's hand rests on the Gryphaea rudstone horizor underlain by the TA (Top Atco) surface. This orizon is recognizable by the abundant lauconite. Inoceramid fragments, and the tightly acked nature of the Grvphaea ovsters. This shell laver is traceable 30 kilometers to the southwest on Leon Creek and has been documented to extend as far west as Medina County. This particular Gryphaea horizon should not be confused with the Gryphaea aucella lumachelle present in the Dessau Chalk recognized at the type section in Travis County and t the very top of the Austin Chalk in Bexar County.

SW Atascosa Wilsor Wilson Wilson Austin "F

All well logs measured in feet Water well logs are listed by their State Well Number assigned by the TWDB Oil well logs are listed by their API number

Subsurface Strike Trend

NE

B



Discussion & Synthesis

- The Lower Austin Chalk (Atco) in the vicinity of the San Marcos Arch consists of argillaceous chalky mud- and iltstones, and is very thin on the arch axis even into the shallow subsurface (~1,500 ft) and thickens greatly to the southwest along the outcrop trend in the vicinity of San Antonio, Bexar County.
- Previous research on nannofossil biostratigraphy has established the presence of an expanded Atco (Lower Austin) section in Bexar County that confirms the thickening of the Lower Austin in the area (Jiang, 1989
- The presence of a 45 cm-thick horizon from Bexar to Medina County consisting of densely packed Gryphaea oysters, Inoceramid fragments, and the occasional fragmented rudist (Durania) within a glauconitic, clay-rich natrix was recognized by Durham (1957) as being the top of the Atco in the area.
- The Middle Austin Chalk (Vinson) in the vicinity of the San Marcos Arch consists of true chalks, but contains an abundance of fine skeletal material just off the arch axis in San Antonio where a facies transition takes place to skeletal wackestones and packstones
- A 30 cm-thick bentonite (ASH horizon) is present towards the top of the Vinson Chalk in Bexar County and could represent a significant "shale" marker in the subsurface with a high spike in Thorium from spectral gamma ray data.
- Two prominent bored hardgrounds toward the very top of the Austin Chalk bound the Gryphaea aucella lumachelle (Dessau) at the Longhorn Quarry, Bexar County where it is only 1.5 meters thick.
- The Dessau Chalk is ~25 m at the type section along Walnut Creek in Travis County and thins over the San Marcos Arch but appears to reach its minimum thickness in Bexar County which could indicate periodic shifts in tectonically stable regions of a subsiding shelf during the Late Cretaceous.
- The upper bored hardground marks the Austin-Taylor Group contact and is overlain by a 5 cm thick phosphatic conglomerate and exhibits a sharp gamma ray spike in Uranium providing an excellent log marker.
- Integration of outcrop and subsurface data from the San Marcos Arch documents substantial lateral variations in depositional geometries within Austin Chalk units and even shows shifts in depocenters between the Lower and Upper Austin Chalk sediments.

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References