Zircon U–Pb Geochronology and Sources of Volcanic Ash Beds in the Upper Cretaceous Eagle Ford Shale, South Texas

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ABSTRACT

The Eagle Ford Shale and equivalent Boquillas Formation (Late Cretaceous) contain abundant volcanic ash beds of varying thickness. These ash beds represent a unique facies that displays a range of sedimentary structures, bed continuity, and diagenetic alteration. They are prominent not only in West Texas outcrops, but also in the subsurface of South Texas where hydrocarbon exploration and production is active. Additionally, the ash beds have potential for stratigraphic correlation and most importantly for obtaining high-resolution geochronology, which can then be used for defining depositional rates, chronostratigraphy, and facies architecture.

Ash beds were sampled from outcrops in West Texas, subsurface cores in Central Texas, and at near surface exposures in Austin, Texas. The ash beds were collected throughout the entirety of the Eagle Ford succession and ranged in thickness from 0.05–13 inches. The ash beds contained high amounts of non-detrital zircons that were dated using U–Pb. High-resolution ages were obtained by laser ablation analysis of zircons collected from ash beds at the base and top of the Eagle Ford, as well as at the Cenomanian-Turonian boundary. U–Pb ages indicate the Eagle Ford in West Texas ranges in age from early Cenomanian (96.8 Ma +1.2/-0.7 Ma) to early Coniacian (87.1 ± 0.3 Ma), a duration of about 9.7 Ma. By contrast, the top of the succession in the Austin area extends only to the late Turonian (91.6 +0.6/-0.4 Ma). Ash bed ages from subsurface cores define the base of the Eagle Ford to be, at least locally, much younger than observed elsewhere (94.66 ± 0.36 Ma) which can be attributed to the development of significant precursor topography at the beginning of the Eagle Ford transgression. Dates for the Cenomanian-Turonian boundary interval are consistent with those defined in previous studies.

X-ray fluorescence (XRF) and diffraction (XRD), radiometrics, and rare earth element (REE) analysis of ash beds were combined with knowledge of paleowind that sug-

gests likely sources of the ash beds are from arc volcanoes in northern and central Mexico and proximal volcanoes in Central Texas from the Balcones Igneous Province. This study is the first detailed regional analysis of the age, geochemistry, and source of the ash beds in the Eagle Ford Shale and equivalent Boquillas Formation. As such, it provides key insights into the age and duration of this system, serves as a basis for better interpretations of facies interrelationships, and places constraints on the interpretation of biostratigraphic and chemostratigraphic indicators of temporal relationships throughout the region.