ABSTRACT

STYLE, TIMING AND UPLIFT HISTORY OF THE FRONTAL SIERRA MADRE ORIENTAL FOLD BELT DETERMINED THROUGH ANALYSIS OF GROWTH STRATA AND VITRINITE REFLECTANCE

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Growth strata deposited in lower and upper shoreface environments in the Las Encinas and Rancho Nuevo formations indicate a Maastrichtian age for fold development in the northern part of the Parras basin. The El Tulillo folds developed through detachment folding and limb rotation during northward propagation of the Sierra Madre Oriental fold belt into the foreland basin, suggesting a pre-Maastrichtian deformation age for the fold belt itself. The growth of the El Tulillo folds impacted facies relationships, causing shallow water facies to be deposited near topographic highs created by anticlinal crests and deeper water facies to be deposited in synclinal troughs. Petrographic data indicate the source of the Cerro Grande, Las Encinas and Rancho Nuevo formations was the Sierra Madre Oriental fold belt with minor volcanic input derived from the Guerrero composite terrane of western Mexico, which is consistent with comparisons of previous provenance studies of the Difunta

Group. Two detachment levels cause east-west-trending fold development in the Parras basin, one at depths ~2 km below the surface in the Cañon del Tule Formation and one at ~ 3 km in the Parras Shale. These two detachment levels were themselves folded by uplift of the northwest-trending La Gavia anticline, with a lowermost detachment level in Jurassic evaporites during inversion of the La Popa basin. These relationships suggest that the east-west-trending folds developed prior to the mid-Maastrichtian, the onset of active northwest-trending La Popa shortening. Vitrinite reflectance analyses used to compare burial depths in the study area and locations to the south in the Sierra Madre Oriental fold belt indicate that the entire area has experienced burial depths of 3.6 to 5.3 km below sea level, after which the strata were uplifted to elevations between 0.8 to 1.5 km above sea level. Comparison of burial and uplift amounts in the study area and closer to the fold belt indicates that the geometry of the fold belt during the Maastrichtian was similar to its present day geometry and that the entire area has been uplifted as a plateau.