

## Detachment levels in the Marathon fold and thrust belt, west Texas

James B. Chapman\*, Reid S. McCarty

SandRidge Energy, 123 Robert S. Kerr Ave., Oklahoma City, OK 73102, USA

### ARTICLE INFO

#### Article history:

Received 12 September 2012

Received in revised form

7 January 2013

Accepted 16 January 2013

Available online 30 January 2013

#### Keywords:

Marathon

Ouachita

Fold and thrust belt

Décollement

Detachment

Tesnus

### ABSTRACT

Surface and subsurface data are integrated to characterize the structural architecture of the Marathon fold and thrust belt in west Texas. Multiple detachment levels are present within the thrust belt and result in distinct structural domains. In addition to the basal décollement, whose stratigraphic position varies along strike, we recognize a regionally extensive detachment zone in the late Mississippian to early Pennsylvanian lower Tesnus Formation. The Lower Tesnus Detachment forms a structural domain boundary that can be observed along strike in the surface data and at depth in the subsurface. The stratigraphic intervals above and below this detachment exhibit characteristic patterns of deformation. The Lower Tesnus Detachment is folded by imbrication and the formation of duplexes in the early Mississippian to Ordovician section, suggesting that the detachment may have initially formed as a perched décollement in the foreland that was subsequently exploited as a roof thrust in a duplex system as deformation progressed in a break-forward sequence and older strata were incorporated into the toe of the allochthonous wedge. The structural model presented here for the Marathon region may be applicable across much of the Ouachita orogenic system.

© 2013 Elsevier Ltd. All rights reserved.

### 1. Introduction

The Marathon fold and thrust belt is a salient in the Ouachita orogenic system that is partially exposed in west Texas. The interior structure of the Marathon fold and thrust belt is locally exposed at the northeast end of the Dagger Flat anticlinorium where the thrust belt plunges to the northeast (Fig. 1), providing a down-plunge view through most of the stratigraphic section. Many researchers have noted the presence of multiple detachments within the stratigraphic section based on studies of the surface geology (Muehlberger et al., 1984; Hickman et al., 2009; Tauvers, 1985; Reed and Strickler, 1990). However, the extent and structural importance of these detachments has not been fully realized with the limited amount of data available at the surface.

In this paper, we present new data that highlights the significance of a detachment in the lower Tesnus Formation, herein referred to as the Lower Tesnus Detachment. We incorporate the surface data with subsurface information recently acquired as part of exploration efforts in the Marathon fold and thrust belt. Our observations suggest that the Lower Tesnus Detachment extends across much of the Marathon Fold and Thrust belt and that a detachment within the shale-rich, late Mississippian to early

Pennsylvanian strata, equivalent with and including the lower Tesnus Formation, may be a fundamental feature of the external Ouachita thrust system.

### 2. Regional stratigraphy and structural lithic units

The Marathon fold and thrust belt is a thin-skinned thrust belt that contains late Cambrian to earliest Permian strata (Fig. 2). The allochthonous sedimentary section is divided into three main structural lithic units bounded by detachment zones (Muehlberger, 1979; Tauvers, 1985; Muehlberger and Tauvers, 1989; Reed and Strickler, 1990). The lower structural lithic unit is defined by a décollement at the base of the late Cambrian Dagger Flat Sandstone and an upper detachment in the middle Ordovician Woods Hollow Shale (Muehlberger and Tauvers, 1989). King (1937) also reports a local detachment in the middle Ordovician Alsate Shale, which may replace the detachment in the Woods Hollow Shale as the main detachment zone bounding the top of the lower structural lithic unit in the study area for this report. Competent intervals within the lower structural lithic unit include the Fort Peña Formation and to a lesser extent, the Marathon Limestone. The lower structural lithic unit is characterized by numerous duplexes containing tight to isoclinal folds with wavelengths  $\leq 1$  km and is observed within the core of the Dagger Flat anticlinorium (Muehlberger and Tauvers, 1989). Along strike from the Dagger Flat anticlinorium to the northeast, the lower structural lithic unit is not present at depth and the basal décollement steps upward into the

\* Corresponding author.

E-mail addresses: [jchapman@sandridgeenergy.com](mailto:jchapman@sandridgeenergy.com) (J.B. Chapman), [rmccarty@sandridgeenergy.com](mailto:rmccarty@sandridgeenergy.com) (R.S. McCarty).

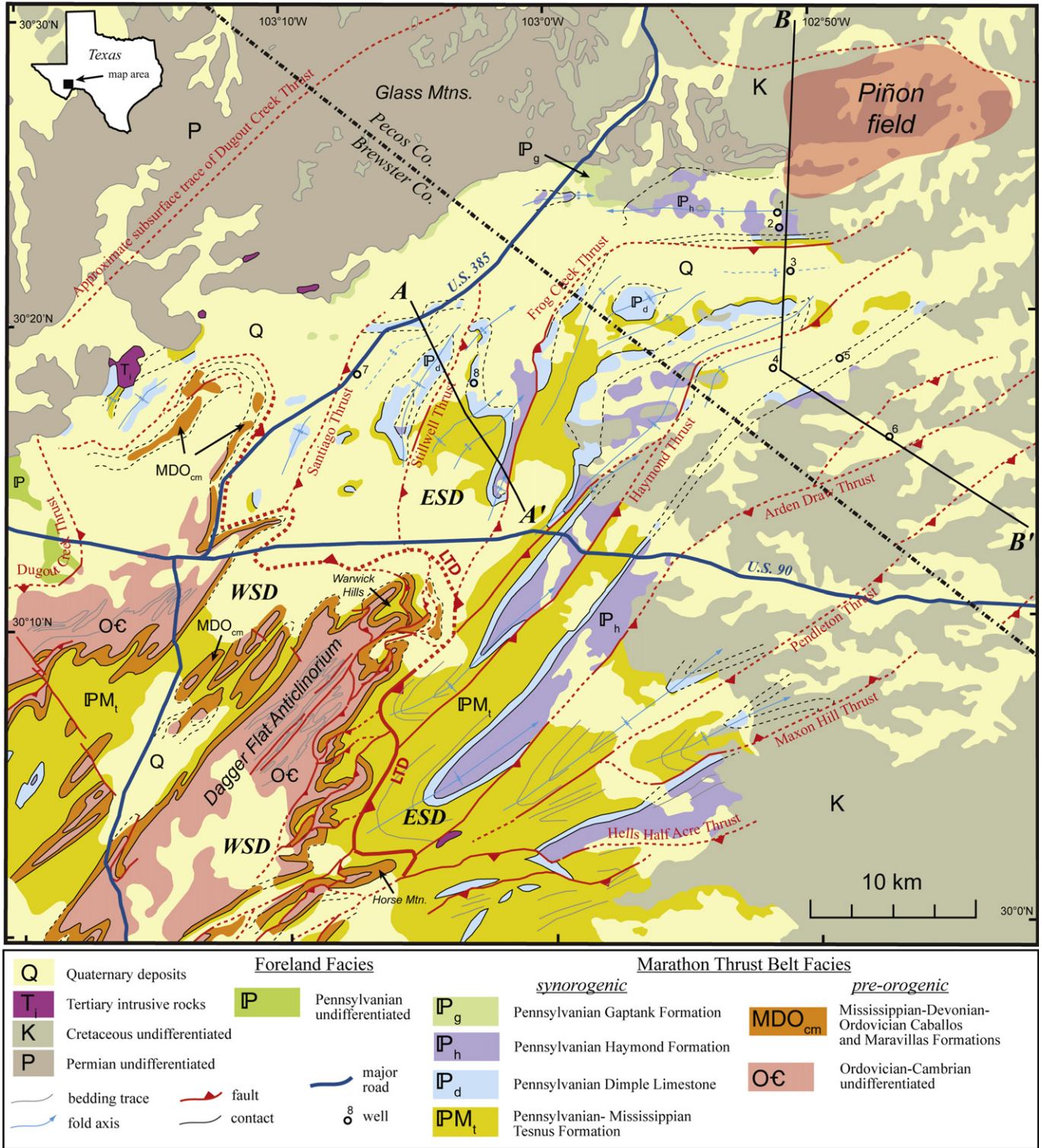


Fig. 1. Geologic map for part of the Marathon Fold and Thrust Belt showing main structures and location of cross sections. Geology modified from King (1937, 1980) and Muehlberger et al. (1984). Eastern structural domain (ESD), Western structural domain (WSD), Lower Tesnus Detachment (LTD). Well information in Appendix 1.

middle Ordovician Woods Hollow Shale (Tauvers, 1988) or Alsate Shale (this study).

The middle structural lithic unit is bounded below by a detachment in the Woods Hollow Shale or Alsate Shale and above by the Lower Tesnus Detachment in the shale-rich, late Mississippian, lower Tesnus Formation. The middle structural lithic unit includes the late Ordovician Maravillas Chert and Devonian to early

Mississippian Caballos Novaculite (Fig. 2), which together form a structurally competent couplet and are important structural markers as well as significant hydrocarbon reservoirs throughout the Marathon fold and thrust belt. Extensive stylitized bedding surfaces in the Caballos Novaculite inhibit bedding plane slip and deformation is achieved through pervasive brittle fracturing. Duplexing and imbrication of the middle structural lithic unit is

Download English Version:

<https://daneshyari.com/en/article/4733207>

Download Persian Version:

<https://daneshyari.com/article/4733207>

[Daneshyari.com](https://daneshyari.com)