

# **Characterization of Potential Lacustrine Carbonate Reservoirs: The Microbial/Algal Buildups and Associated Carbonate Deposits from the Eocene Green River Formation\***

**Claire Seard<sup>1</sup>, Gilbert Camoin<sup>1</sup>, Jean-Marie Rouchy<sup>2</sup>, Aurélien Virgone<sup>3</sup>,  
Cecile Pabian-Goyheneche<sup>3</sup>, and Emmanuelle Poli<sup>3</sup>**

Search and Discovery Article #50522 (2012)

Posted January 17, 2012

\*Adapted from oral presentation at AAPG International Conference and Exhibition, Milan, Italy, October 23-26, 2011

<sup>1</sup>CEREGE, Aix en Provence, France ([seard@cerege.fr](mailto:seard@cerege.fr))

<sup>2</sup>Muséum National d'Histoire Naturelle, Paris, France

<sup>3</sup>TOTAL, Pau, France

## **General Statement**

The lacustrine Green River Formation of Wyoming, Colorado, and Utah (USA) was deposited in a series of continental basins that occupy a broken foreland province to the east of the Cordilleran fold and thrust belt during the Eocene (53.5 to 48.5 Ma). The two major basins are the Greater Green River Basin and the Uinta - Piceance Creek Basin (the so-called “Gosiute and Uinta lakes”), which are separated by the east-west-trending, Uinta uplift (e.g., Bradley, 1964; Roehler, 1992; [Figure 1](#)). The lacustrine depocenters formed in structural depressions fringed by Laramide ranges where subsidence rates exceeded sedimentation rates.

These lacustrine systems were composed of a core of open-lacustrine facies (“oil shales”), flanked successively shoreward by the marginal-lacustrine and alluvial facies (Ryder et al., 1976). In contrast to the oil-shale open facies, which were extensively documented in the literature, the carbonate margins of those systems have received little attention (e.g., Roehler, 1973, 1993; Leggitt and Cushman, 2001; Leggitt and Loewen, 2002).

This article focuses on the northern carbonate margins of Eocene Lake Gosiute in southwest Wyoming (near LaBarge; [Figure 1](#)) that developed during deposition of the Laney Member of the Green River Formation, when Lake Gosiute was expanding over the floodplains and mudflats of the Cathedral Bluffs Tongue of the Wasatch Formation.

The objectives of our field study are: 1) to reconstruct the architecture of the carbonate margin, 2) to propose a depositional model of the marginal lacustrine systems, and 3) to characterize the reservoir properties of the carbonate facies based on CT-scan analysis and petrophysical measurements.

## Marginal Carbonate Deposits

The marginal carbonate deposits extend over more than tens of kilometers in length and a few kilometers in width. They are usually composed of large carbonate bodies ([Figure 2](#); up to 15 m-thick) resulting from the piling-up of buildups made of microbial/algal components and aggregates of insect larval cases associated with other carbonate deposits, mostly ostracod and ooid grainstone-packstone, and sandy and silty limestones.

Buildups exhibit various morphologies, mostly domal or columnar forms and are composed of a core of aggregates of insect larval cases encrusted by laminated or mamillated stromatolitic accretions. Aggregates of insect larval cases played a prominent role in the initiation and the development of carbonate build-ups. The buildups grew in a nearshore, lacustrine environment during the early Laney transgressive phase and form reef-like geometries at the top of the sequence.

The ostracod and ooid-rich limestones include abundant reworked elements including shales from the underlying Cathedral Bluffs Tongue, concretions formed by aggregates of insect larval cases, vegetal stems, chips of stromatolitic accretions and oolitic limestones. Channels are common features in these limestones.

These carbonate units represent potential carbonate reservoirs with porosities ranging from 5 to 30%.

## References

- Bradley, W.H., 1964, Geology of the Green River Formation and associated Eocene rocks in southwestern Wyoming and adjacent parts of Colorado and Utah: U.S. Geological Survey, Professional Paper 496-B, p. 1-71.
- Leggitt, V.L., and R.A. Cushman, Jr., 2001, Complex caddisfly-dominated bioherms from the Eocene Green River Formation: *Journal of Sedimentary Geology*, v. 135/3-4, p. 377-396.
- Leggitt, V. L., and M.A. Loewen, 2002, Eocene Green River Formation "Oocardium tufa" reinterpreted as complex arrays of calcified caddisfly (Insecta: Trichoptera) larval cases: *Sedimentary Geology*, v. 148/1-2, p. 139-146.
- Roehler, H.W., 1993. Eocene climates, depositional environments, and geography, Greater Green River Basin, Wyoming, Utah, and Colorado: U.S. Geological Survey, Prof. Paper 1506-F, 74 p.
- Roehler, H.W., 1992. Description and correlation of Eocene rocks in stratigraphic reference sections for the Green River and Washakie Basins, southwest Wyoming: U.S. Geological Survey, Professional Paper 1506-D, 83 p.
- Roehler, H.W., 1973, Stratigraphy of the Washakie Formation in the Washakie Basin, Wyoming: U.S. Geological Survey Bulletin 1369, 40 p.

Ryder, R.T., T.D. Fouch, and J.H. Elison, 1976, Early Tertiary sedimentation in the western Uinta Basin, Utah: Geological Society of America Bulletin, v. 87, p. 496–592.

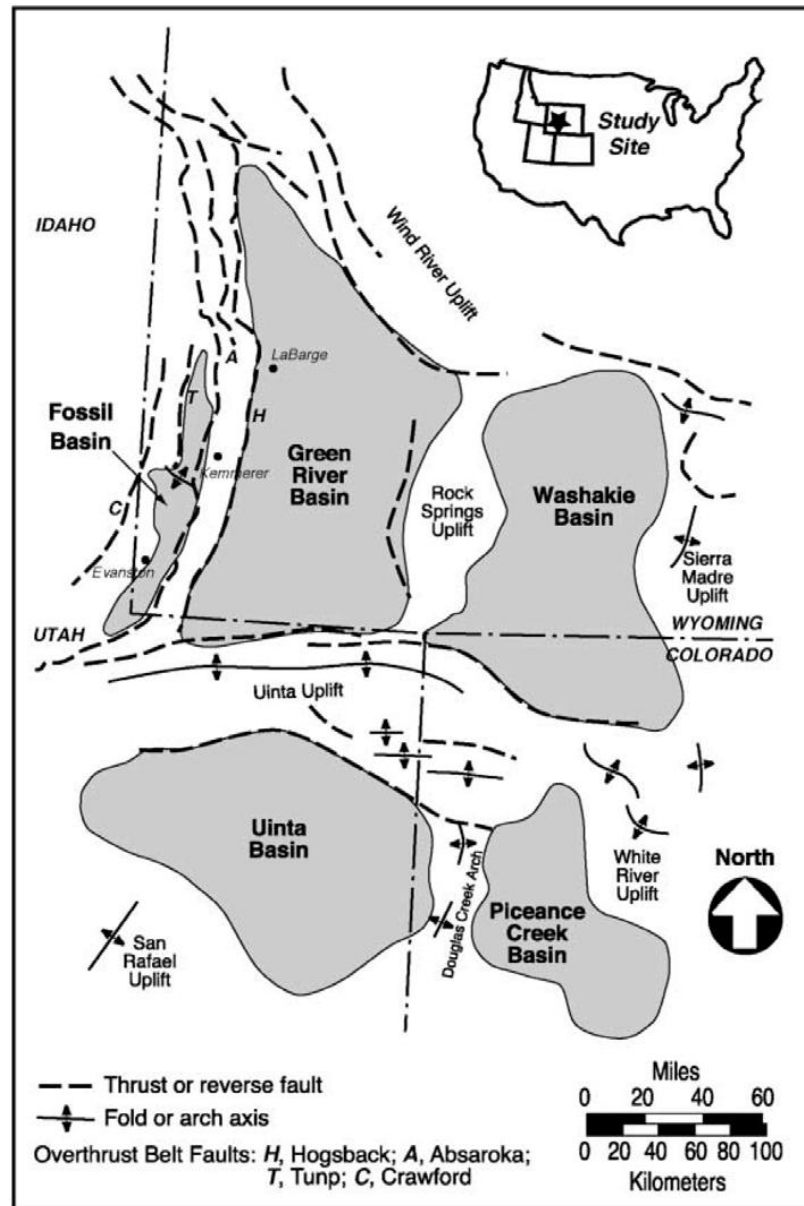


Figure 1: Location map of the Green River, Washakie, Uinta and Piceance Creek basins in which the Green River Formation was deposited (from Leggitt and Cushman, 2001).

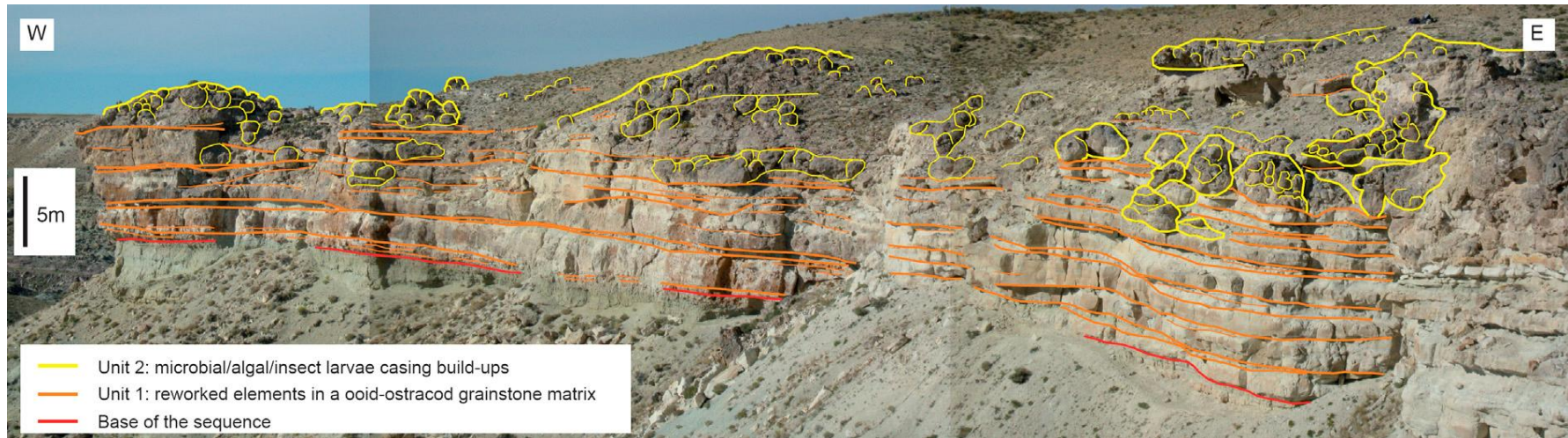


Figure 2: Carbonate sequence (~10 m-thick) of the Laney Member that developed over the shaly siltstones of the Wasatch Formation (Cathedral Bluffs Tongue). This sequence is composed of 2 units: 1) a basal unit with beds of sandy and silty ostracod-rich limestones with abundant reworked elements; and 2) an upper unit with microbial/algal/insect-larval-cases buildups composed by the lateral and vertical merging of domes that form reef-like geometries.