

In Search of a New Play in the Infracambrian Petroleum System of the Bikaner-Nagaur Basin in Rajasthan*

Miles Leggett¹

Search and Discovery Article #10393 (2012)

Posted February 20, 2012

*Adapted from extended abstract presented at GEO-India, Greater Noida, New Delhi, India, January 12-14, 2011

GeoGlobal Resources (Canada) Inc., Calgary, Canada (miles.leggett@geoglobal.com)

Abstract

The Bikaner-Nagaur Basin in Rajasthan, India, is a proven petroleum basin with the potential for billions of barrels of additional reserves. The Basin has undergone two extensions and two compressions in the last 600 million years, preserving Precambrian structures that have filled with hydrocarbons during the Permian, sourced from Infracambrian rocks (the Marwar Supergroup). This hydrocarbon system is contemporaneous with and linked to the prolific and well understood Ghaba and Fahud Salt Basins of Southern Oman. The Oman province has been assessed at containing 11.3 billion bbls of recoverable oil.

A recent (2008) 1600 sq km 3-D seismic survey has enabled the exploration teams to view this exciting basin with new eyes, opening up the potential for deeper prospects in these ancient sediments in two exploration blocks located to the west and east of the Billion Barrel Baghewala Oil Field. The burial history of the deeper prospects on the flanks indicates that there is a greater chance of finding lighter oil in significant quantities in the Precambrian Jodhpur sands, with excellent preserved reservoir quality. Interpretation of the 3-D seismic dataset leads us to believe that there may be preserved Precambrian sediment below what has been traditionally thought of as economic basement, but never fully explored. These deeper targets have never been penetrated but are to be added as a tertiary target in the first phase of exploration drilling.

The first exploration well, Rachan#1, was spud on April 21st 2010 with the main target being the Upper Carbonate and the Jodhpur Sandstone; this well is also targeting the deeper zones and the results will be incorporated into the presentation.

Location of the Blocks and Regional Geological Setting

The two NELP-VI blocks (RJ-ONN-2004/2 and RJ-ONN-2004/3) are located in the Thar Desert region in Northern Rajasthan (see [Figure 1](#)). Together they cover approximately 3526 sq km. These blocks lie in the geological province of the Bikaner-Nagaur Basin (see [Figure 2](#)).

The basin is a distant (SE) segment of the Salt Range Tectonic Province of Northern Pakistan and is defined by subcrop limit in the West by the Base Permian Unconformity and by surface outcrop in the East and South. It extends Northwards under the Punjab platform to the

Potwar Region and the Salt Ranges in Pakistan.

Tectonic History

The Bikaner-Nagaur Basin has undergone two extensions and two compressions in the last 600 million years. The structures that we see today have been preserved since the Permian with little additional movement to affect their integrity. A general outline of the tectonic history is outlined below and summarized in the Petroleum Events Chart in [Figure 3](#).

1. Late Proterozoic Extension

- a. Linked with the Infracambrian Basins of the Middle East.
- b. Rifting phase gave rise to Malani Igneous Suite (rift-related volcanics).
- c. Significant NW-SE faulted terrane developed.
- d. Deposition of fluvial/marine sandstone sequence begins.

2. Cambrian to Mid-Paleozoic

- a. Intercratonic sag – dormant basin with deposition of alternating sequences of sands, shales, evaporites, and carbonates (Marwar Supergroup).
- b. Mid-Paleozoic compression and uplift results in reverse slip and structural inversion of ancestral rift faults.
- c. Results in development of an en-echelon array of fault and fold defined structural combinations.
- d. Significant thickness (3-4 km) of sediment removed.

3. Cretaceous Extension

- a. Mid-Paleozoic structures buried under a succession of younger sediments.
- b. Steeply dipping clinoforms interpreted as Cretaceous fill associated with the early development of the Cambay Rift Basin.
- c. Subsequent truncation in Tertiary during development of the Himalayan Orogeny.

Exploration Phase/Current Drilling

Current exploration plans for these two blocks include the drilling of 20 wells to 2000 m or the Basement, whichever comes first. There are at least 13 prospects defined with multiple targets in the Upper Carbonate, Bilara and Jodhpur Formations. The first of these prospects is currently being drilled by the well Rachan#1, which is planned to TD in Basement at around 1500 m TVDSS. The results from this well will add to and update our knowledge and understanding of this prolific Infracambrian Petroleum System and pave the way for future exploration efforts in this region.

A structure map of the Jodhpur with the currently drilling location is shown in [Figure 4](#) and a section through the well in [Figure 5](#). The final presentation will have an update once the results of the well are known.

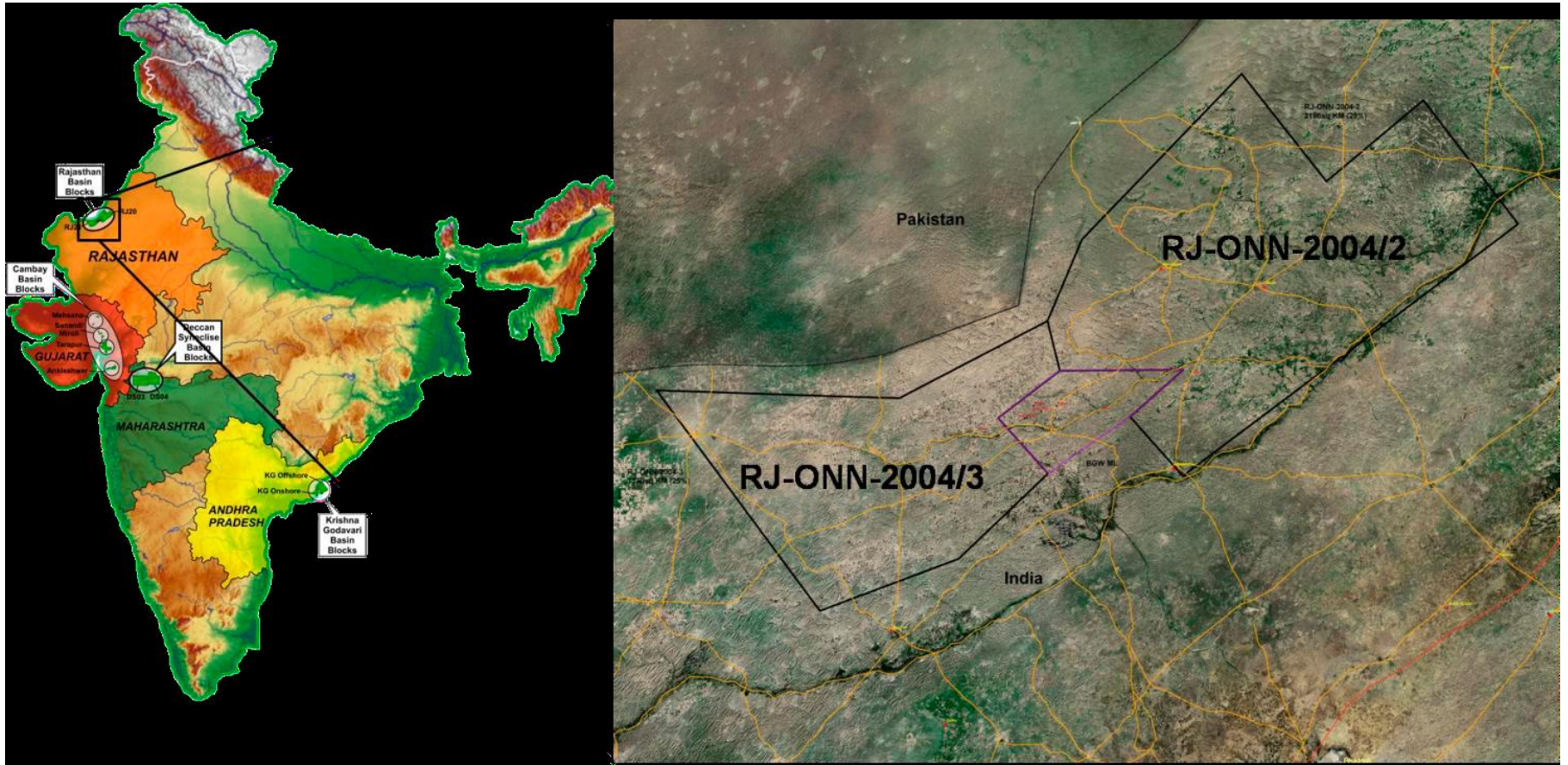


Figure 1. Location of Blocks in the Thar Desert in Rajasthan, India.

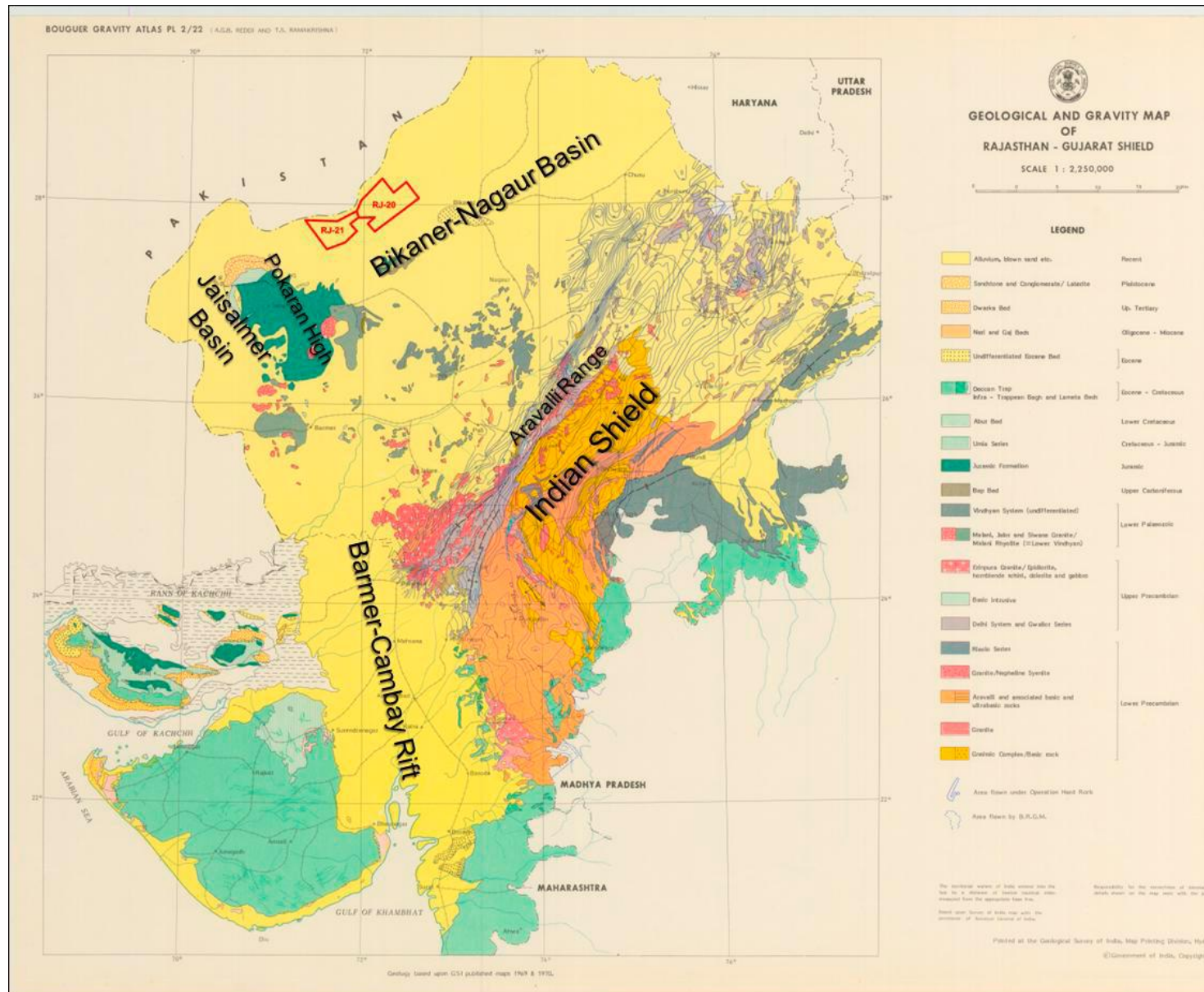


Figure 2. Regional Geological Setting.

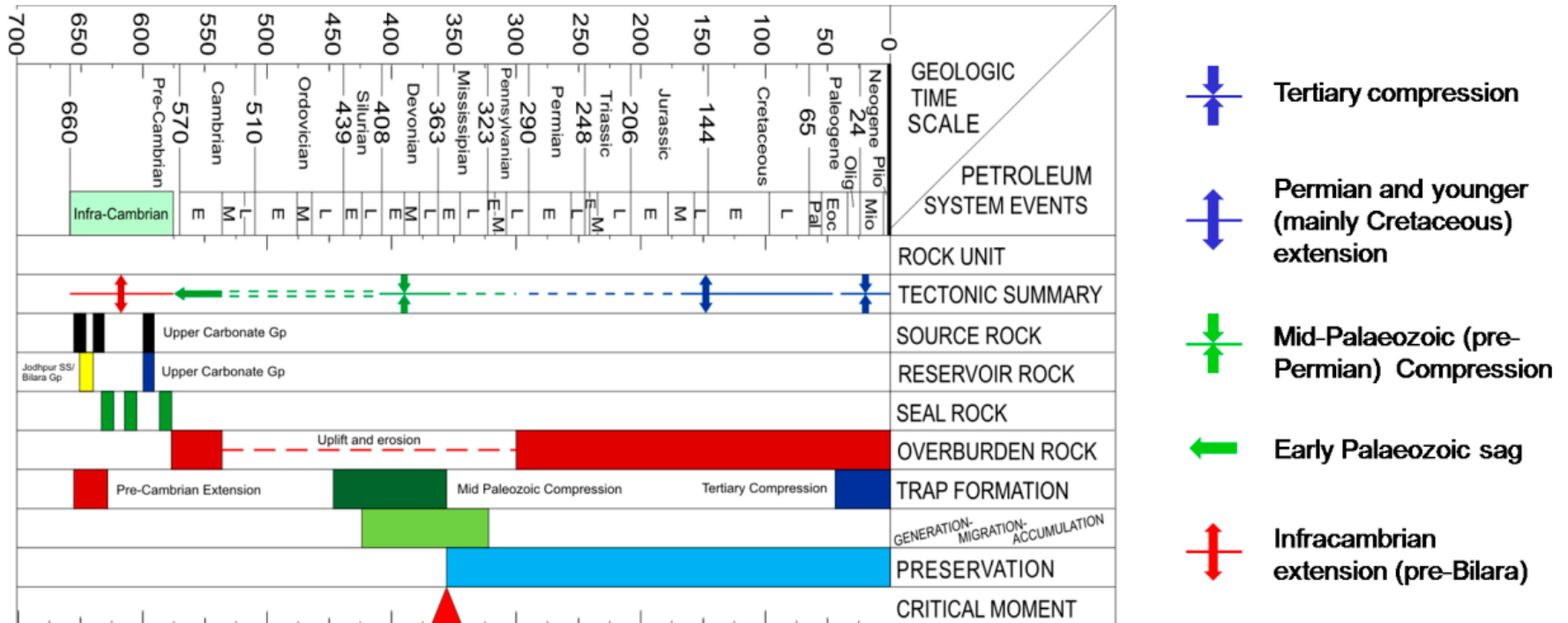


Figure 3. Petroleum Events Chart Outlining Key Events.

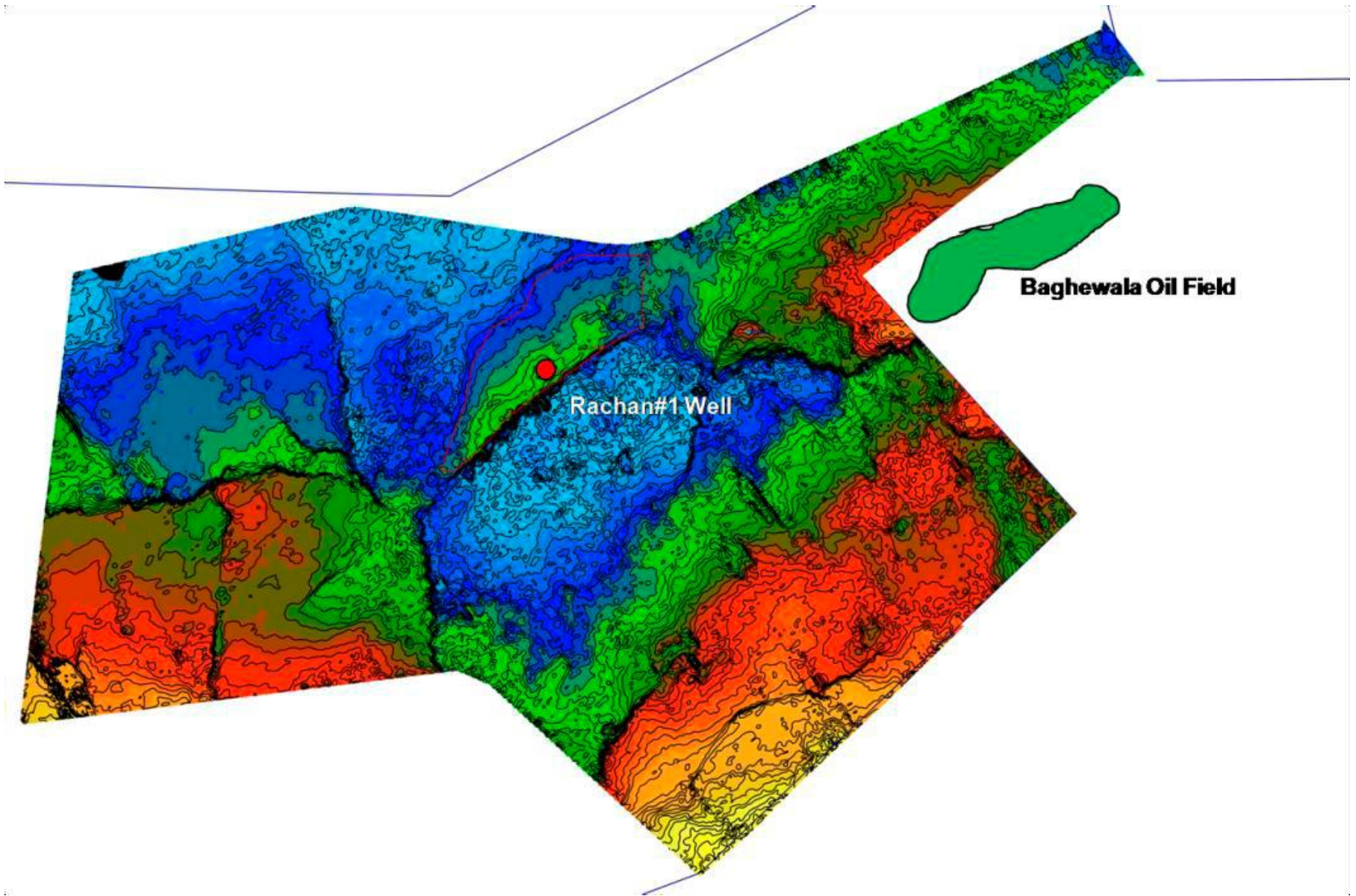


Figure 4. Jodhpur Structural map with location of Rachan#1.

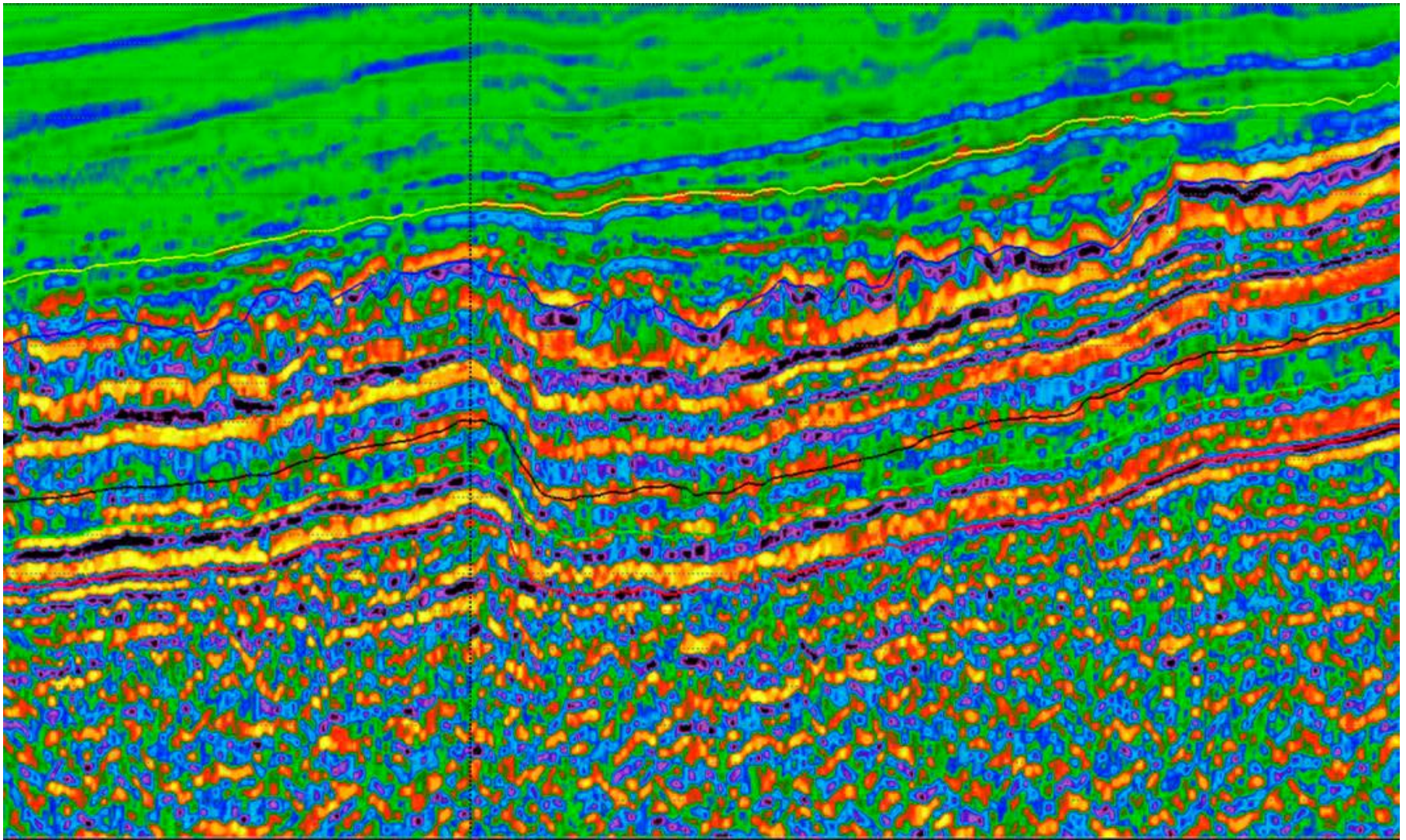


Figure 5. Relative Acoustic Impedance Section through well location.