SGP
FUNDADA 1924

Boletín de la Sociedad Geológica del Perú

journal homepage: www.sgp.org.pe ISSN 0079-1091

Understanding the geologic structural behavior and identifying low-resistivity pay in the Talara Basin

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1. Introduction

The Talara Basin is located on the continental shelf along the northern coast of Peru. Its eastern limit is delineated by the La Brea–Amotape Mountains of the Coastal Range, and the associated uplift that separates the basin from the Lancones and Sechura Basins. The Paleocene Talara basin is superimposed on a larger, Mesozoic and pre-Mesozoic basin. Producing units, ranging in age from Pennsylvanian to Oligocene, are mainly Upper Cretaceous through Oligocene sandstones of fluvial, deltaic, and nearshore to deep-marine depositional origins. The primary reservoirs and greatest potential for future development are Eocene sandstones that include turbidites of the Talara and Salinas groups. Additional production and undiscovered resources exist within Upper Cretaceous, Paleocene, and Oligocene units. The Pennsylvanian Amotape quartzites may be productive where fractured. Trap types in this block-faulted basin are mainly structural or a combination of structure and stratigraphy. Primary reservoir seals are interbedded and overlying marine shales.

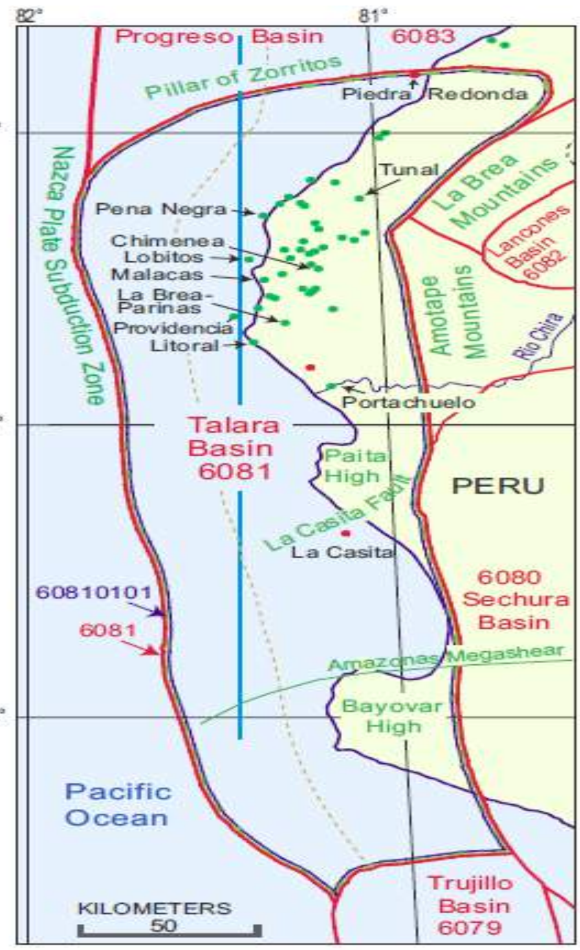

Figura 1. The Talara Basin

2. Geological modeling

In an effort to characterize geological events and identify zones with high potential to produce hydrocarbons, Interoil and Schlumberger both decided to initiate a 3D-resistivity campaign in the Mirador and San Luis fields. In order to obtain a good comprehension of different geologic events which can be used to correlate and update the structural aspects of this field.

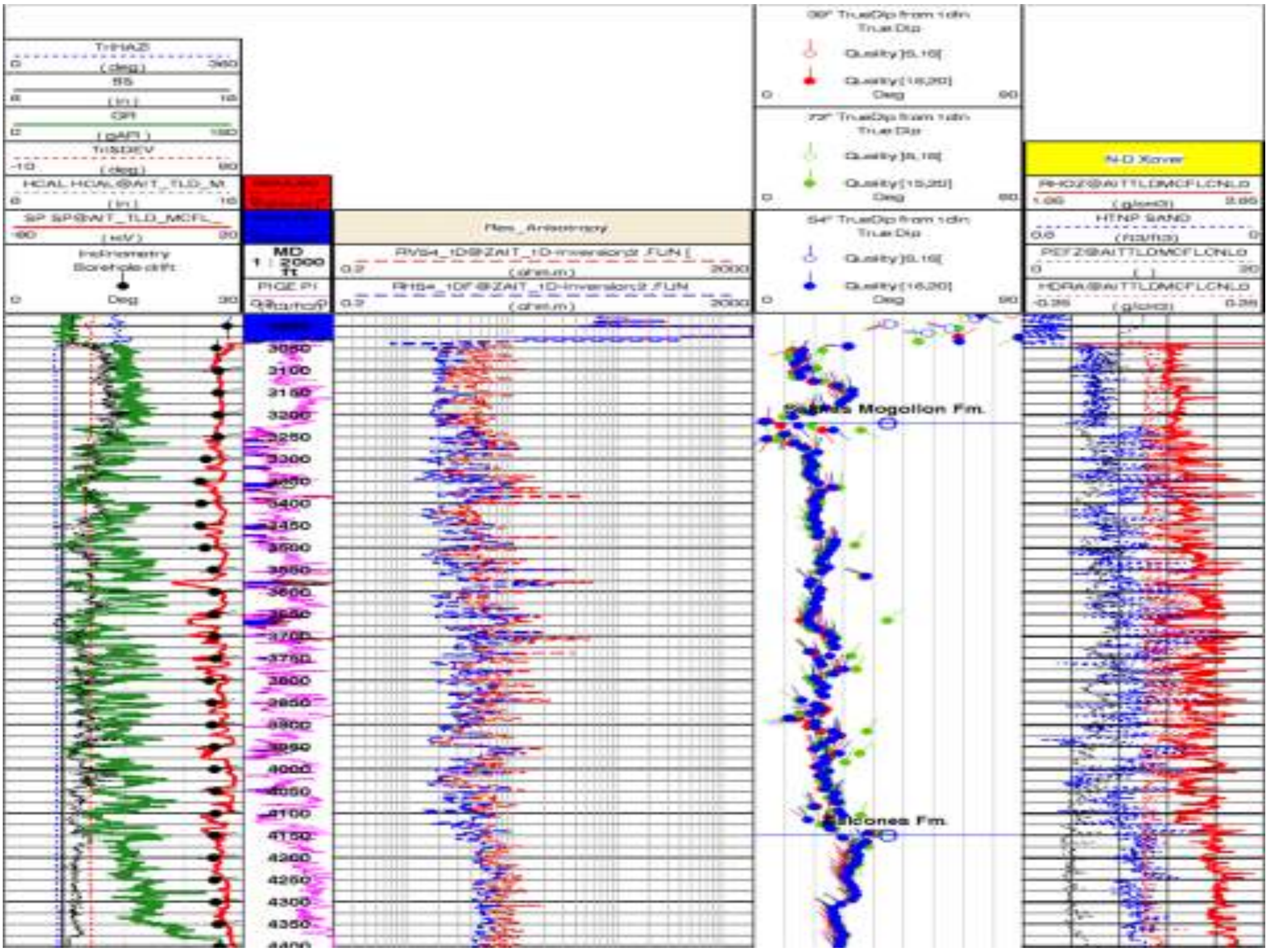

Figura 2. 1D-inversion outputs playback.

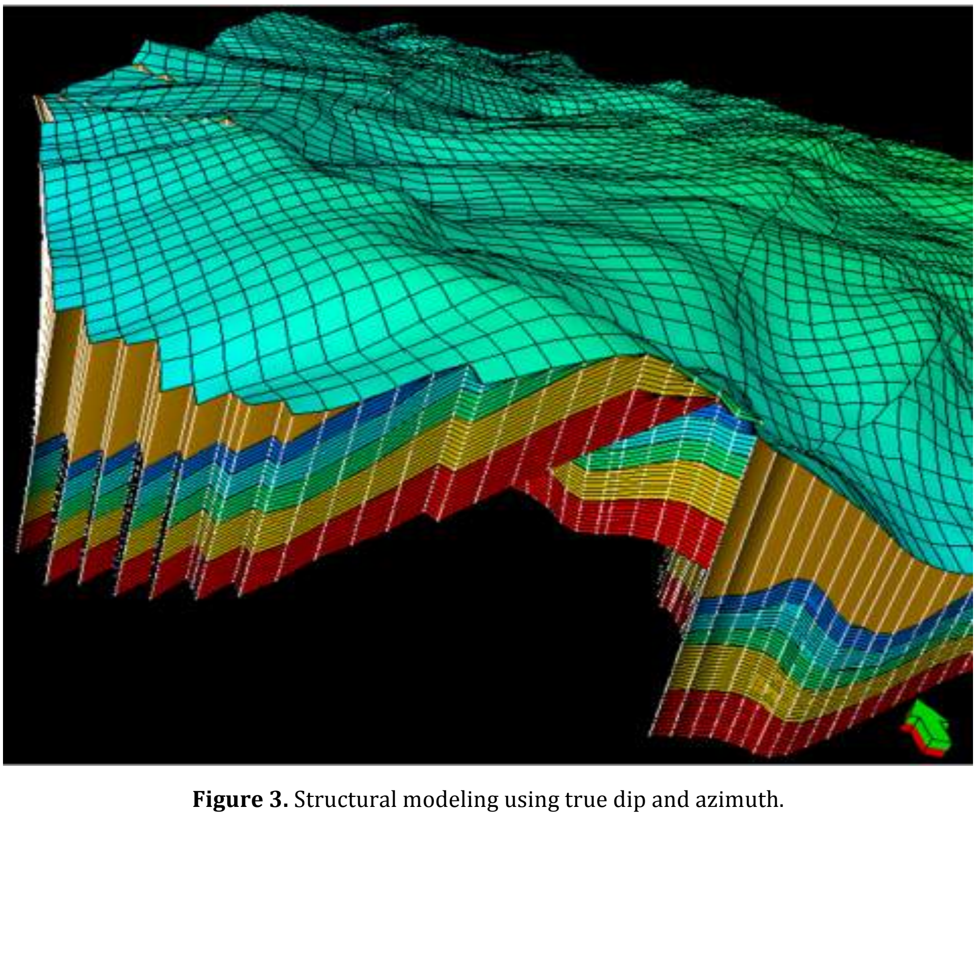

Figure 3. Structural modeling using true dip and azimuth.

Post-processing of 3D-resistivity information allows the computation of beddings through the uses of the following outputs extracted from post processing: horizontal resistivity, vertical resistivity, true dip and azimuth as shown in Figure 2.

It is well known that the Talara Basin has a very complex structural model due to tectonics and a dynamic depositional environment; these were the main causes of several geologic events as main and secondary faults, unconformities, folding, etc. The outputs mentioned above are available from different wells which will are used to build a structural modeling providing a better understanding of structural behavior and updating geological knowledge for both fields.

3. Identification of low-resistivity pay

One of the most difficult things about making a detailed petrophysical evaluation in the Talara basin is dealing with the intercalation of shaly-sand bodies, as conventional logging can be affected by:

• The presence of shale as part of the reservoir affects the neutron porosity reading. It doesn't allow identifying sand bodies with gas and light oil because no crossover with density log can be seen.

• The presence of shale in thin layers within a sand reservoir makes that conventional resistivity measurements behave as a circuit in parallel. These measurements yield lesser resistivity values than vertical resistivity, which behave as circuit in series allowing to identify the shale and sand bodies. This is why, in this kind of fields, conventional resistivities are hiding some sand bodies with a considerable potential to test.

These two effects have a considerable impact in the reservoir volume model.

In order to make a better interpretation of fluids present in thin sand beds in the Mirador and San Luis fields, Rv and Rh concepts are explained and used in this work. Because Rv can help identifying the resistivity of very thin sand bodies without shale effect, one application is to make a laminated or thin bed analysis and compare its results with a conventional analysis to determine which additional intervals will produce (corroborated with pressure and sample points) and what is the additional hydrocarbon volume present in the reservoir. In both cases these interpretations are made using the true resistivity of the unit.

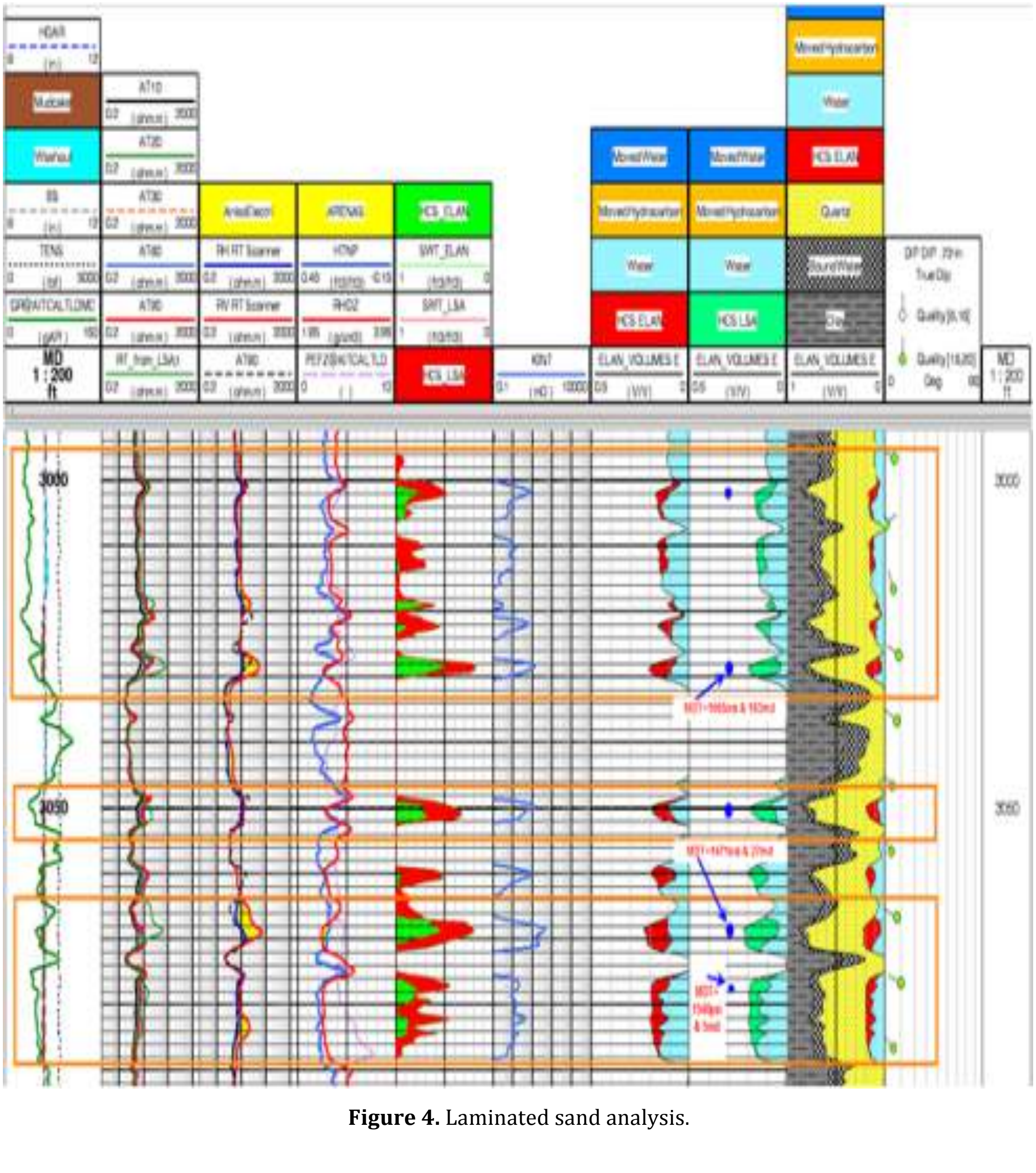

Figure 4. Laminated sand analysis.

4. Expected impact in the industry

The structural modeling will help to achieve a better geologic interpretation of the area as well as well-defined trajectory plans, reducing the risk of well location.

Using vertical and horizontal resistivities, it is possible to identify low-resistivity pay zones, providing additional zones to produce and leading to a better estimation of reserves.

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