The Geological and Geophysical Evaluation of the S-108 Area, Gulf of Paria, Offshore Western Trinidad*

Nancy Gallai[1] and Curtis Archie[1]

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[1]Petrotrin, Exploration & Geophysics, Pointe a Pierre, Trinidad and Tobago (curtis.archie@petrotrin.com)

Abstract

The S-108 area is situated to the northeast of the Soldado Main Field, Gulf of Paria, offshore western Trinidad (Figure 1). This well was drilled in 1962 to a depth of 9622 feet and penetrated a normal stratigraphic sequence from the Forest Formation (Pliocene) at the surface to the Upper Cretaceous Naparima Hill Formation at total depth.

The Forest Formation crops out at water bottom in this area; consequently a deeper marker, the 'Forest 1', was chosen for the initial correlation. Three other markers were subsequently chosen to subdivide the interval into smaller packages. The Forest and Cruse sands (Pliocene) have been interpreted as delta deposits that include channel complexes, distributary mouth bars, crevasse splays, and inter-distributary deposits. These channels generally trend in a southwest to northeast direction.

Structurally, the study area is located on the southern limb of the Soldado Main Field Anticline. It is bounded on the north by a major normal ENE-trending fault, in the west by another major normal NE- trending fault, and in the east by a NE normal fault. Vertical separation across the faults at the Forest level varies from 100 feet-500 feet, with throws to the east. Calculated dip of 5° is comparable to that of a dipmeter run in S-108.

The study initially targeted the Forest interval, but the Upper Cruse (Cruse 1) sands (Pliocene) were later included because amplitude anomalies against faults were observed.

A south-north seismic section through S-108 illustrates the interpreted Top of Forest, Top of Cruse and Top of Lower Cruse (Figure 2). The interpreted fault is a splay of the Los Bajos Fault that has traditionally been called the "Soldado Wrench". Vertical displacement based on the interpretation is small (+/-100 feet); sands are correlatable on either side of the fault; thus horizontal displacement is small. The Forest interval is dominated by fairly continuous reflectors in the S-47 and S-108 area; in the S-80 area the lowermost sand is on a fairly continuous reflector, whereas the shallower sands appear to be discontinuous. Visible are two flat spots in S-108: an upper one associated with a gas-oil contact and a lower one associated with an oil-water contact. In the S-80 area no flat spots are visible, and oil produced from the Forest averages 14^0 API.

Net Sand and Net Oil Sand Maps were drawn for the individual packages, and Structure, RMS Amplitude and Net Hydrocarbon maps for Forest 1 and Cruse 1 were generated. Oil/Water and Gas/Oil contacts were mapped from the wells. Also, RMS amplitudes also conform to structure.

In one RMS amplitude extraction specific to the Forest 1 sand (40 ms above and 60ms below the Fr1 horizon), variations in the amplitude suggest lithological variations within the interval. This variation provides an analogy between the S-759 area amplitude to that of S-108 area. In the S-759 area, high amplitudes within the interval coincide with hydrocarbon-bearing sands. A similar relationship is seen in the S-108 area.

This high amplitude trend is also observed to change parallel specificially to the 1700-foot structural contour (Figure 3). This fit to structure implies a fluid contact, which in this case coincides with an Oil-Water Contact.

At the Cruse 1 level, the major structural elements are similar to those at the Forest level. The vertical separation on the main fault increases from 100 foot to 600 feet. Calculated dips are 33.7°; this agrees with the dipmeter reading. RMS Amplitude anomalies against faults were also observed at the Cruse 1 level.

A gas cap was identified from well-log analysis and its distribution mapped. At the Forest level recoverable reserves are estimated to be 2.6 MMBO and at the Cruse 6.6 MMBO.

S-108 produced 800 barrels of 10.8^0 API oil from a total of 95 feet of NOS from the Forest sands; the well was shut-in shortly afterward due to what were considered as uneconomic production rates at that time. A new development plan was devised that involved the drilling of 2 high-angle wells to increase the amount of reservoir contact and production rates. The first well S-901 was drilled in 2011 to a total depth of 2414 feet and encountered well developed sands with 120 feet of gas, GOC at 1910 feet, 85-foot oil sand and OWC at 2130 feet, as predicted. While drilling gas breakouts occurred at the seabed around the rig, eventually this was controlled and production casing was run. The second well S-902 was drilled to 1024 feet, where 9 5/8” casing was set; drilling was suspended due to the gas breakouts at the water bottom near the drilling rig. The Cruse section was drilled by S-108 but not tested.

The prospective locations from this study were based on updip structural fault closure characterized by high amplitudes and the remaining recoverable reserves.

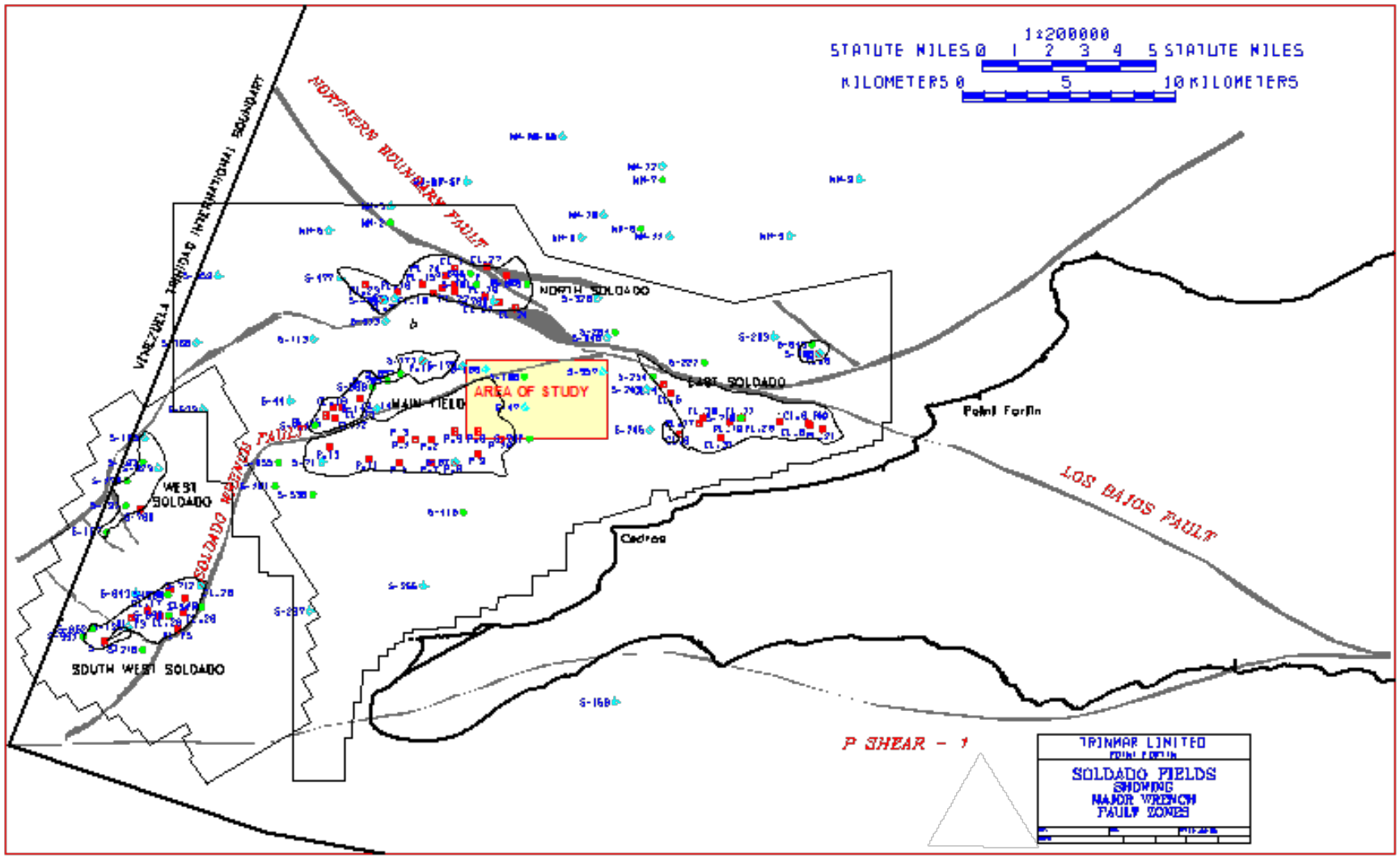

Figure1. Index map of study area.

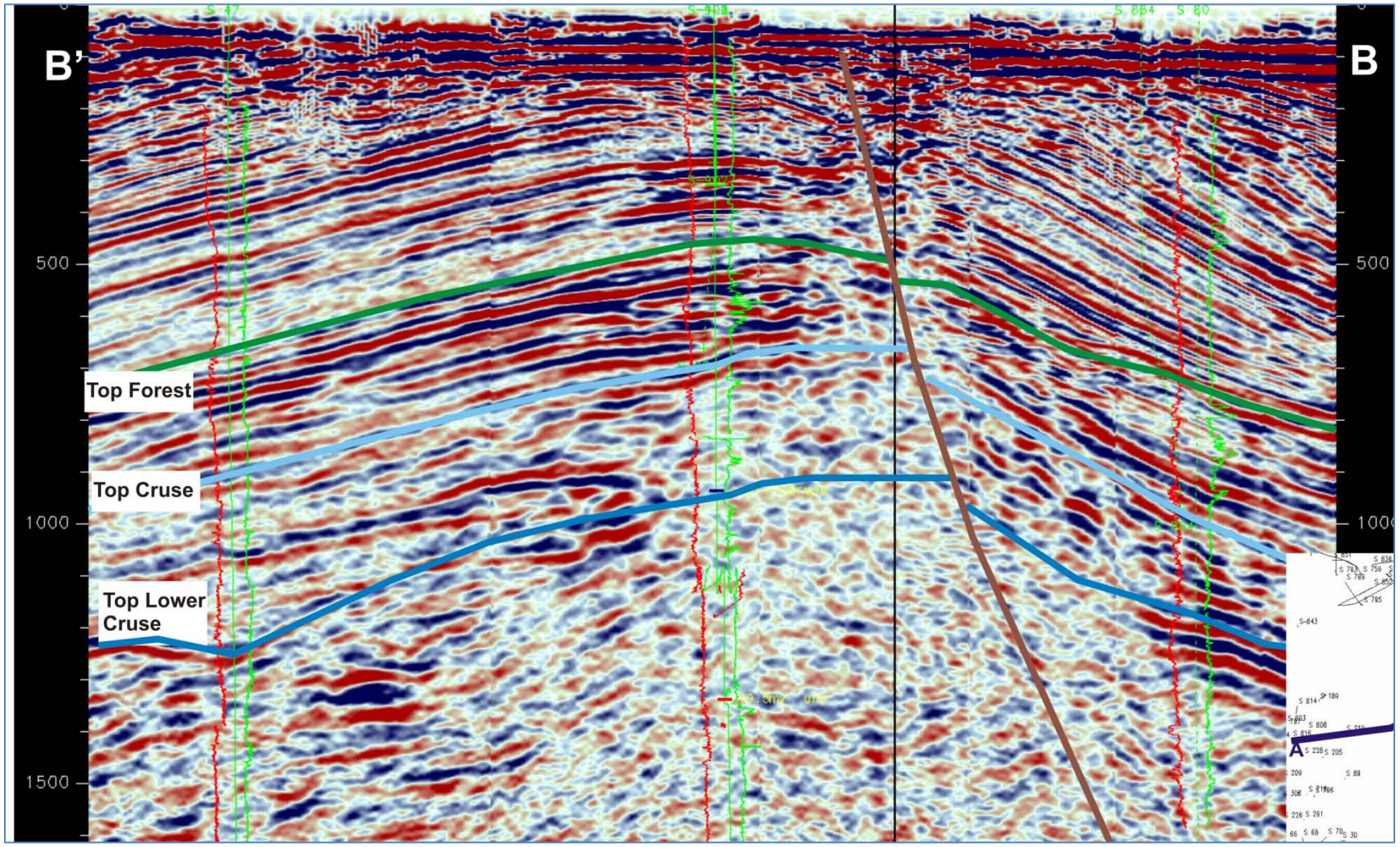

Figure 2. Seismic line illustrating variability of the relationship between amplitude and fluids encountered in wells; also note flat spot.

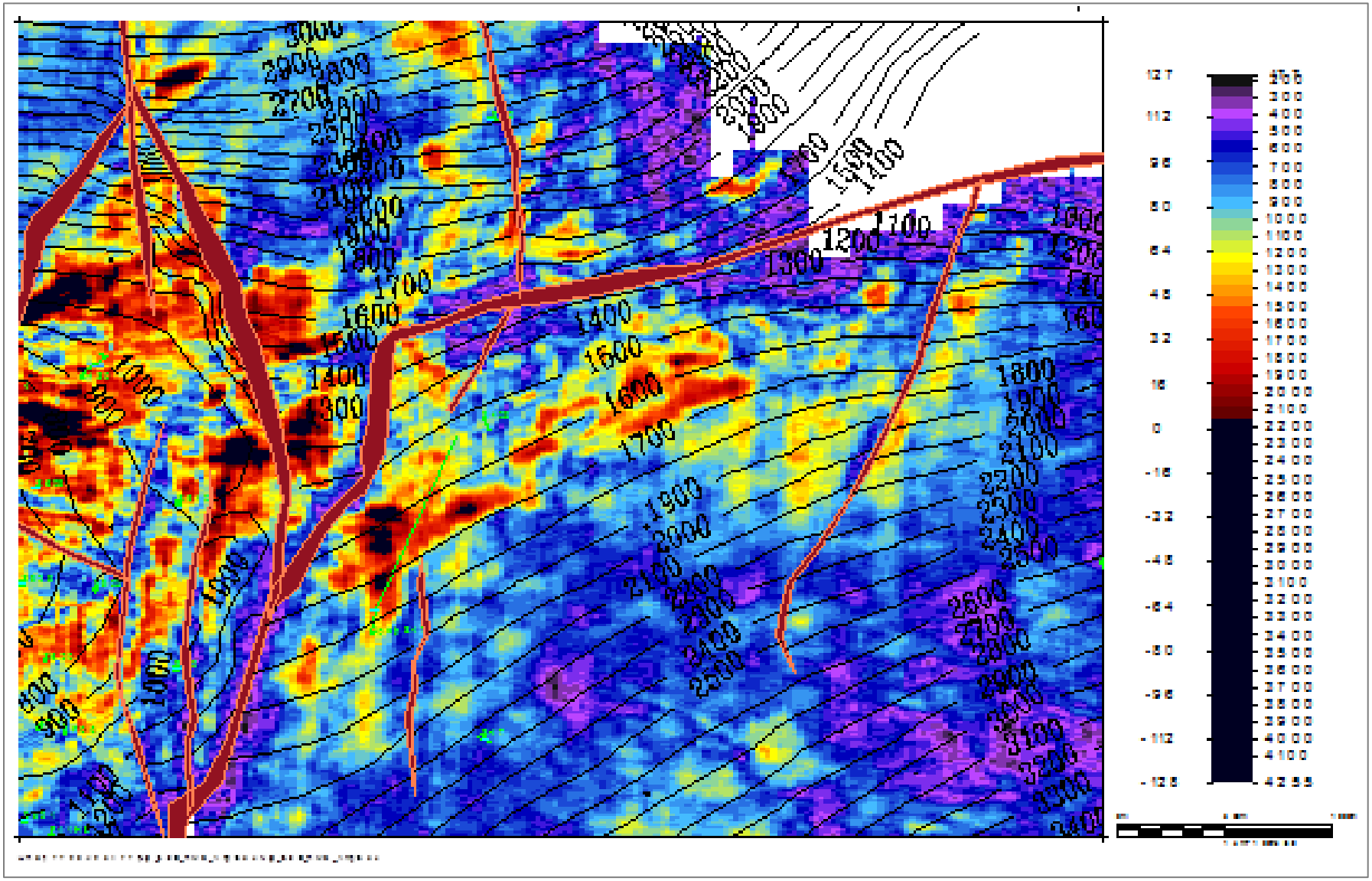

Figure 3. RMS Amplitude extraction for Forest 1 interval, showing reasonable fit to structure.