1987/23. Geology and exploration history of the Tasmanian sector of the Gippsland Basin.

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Abstract

The southern sector of the Gippsland Basin lies in waters of the Tasmania Adjacent Area east of the Furneaux Group in Bass Strait. Three wells drilled to date have not provided a proper test of the hydrocarbon potential of the area.

INTRODUCTION

The offshore Gippsland Basin is Australia's major hydrocarbon province; over 3.2 billion barrels of oil and 0.8 billion barrels of NGL, together with over 8 TCF of natural gas have been discovered (Brown, 1986). Recent exploration success at Kipper indicates that major accumulations are still to be discovered.

The Basin underlies the continental shelf and slope between Victoria and Tasmania and extends onshore into the Latrobe Valley of eastern Victoria (James and Evans, 1971; Threlfall *et al.*, 1976; Thompson, 1986). It is filled with at least 7.5 km of Early Cretaceous to Recent sedimentary infill. The stratigraphy of the offshore basin is shown in Figure 1.

Three major structural elements of the Basin are recognised, separated by fault complexes: the North and South Platforms and the intervening Central Deep (James and Evans, 1971). Largely lying within Tasmanian waters is the South Platform, which is constrained to the north by the Foster Fault, and to the south by the Bassian Rise (fig. 2). This platform forms the continental shelf of north-eastern Tasmania.

PREVIOUS EXPLORATION

The region has been explored previously by Esso/BHP (T4/P), Magellan Petroleum (T/1P, T/9P), and Otter Exploration/Union Texas (T13/P).

Seismic surveys were shot during the period 1965 - 1983. The seismic data is concentrated in the north of the region; there are only a few reconnaissance lines in the south where the Latrobe Group is poorly developed.

The early Esso and Magellan data is generally of poor quality. In 1980 the Otter Group acquired 400 km of data in the Flinders Seismic Survey (line designation 80F-). The survey revealed several small structural and stratigraphic closures in the Latrobe group. A further 183 km was acquired in 1982 (line designation UTP82-) and indicated the presence of several leads in the northern part of the area. The most recent seismic survey in the area was in 1983 and 236 line kilometres of new data were gained (line designation GUT83P-). Seven offshore petroleum exploration wells have been drilled on the South Platform, and of these, three (Mullet-1, Bluebone-1, Sailfish-1) were in Tasmanian waters. The Mullet and Bluebone wells were drilled in 1969 by Esso Australia Ltd to test stratigraphic plays near the basin margin, and Sailfish was drilled by N.S.W. Oil and Gas N.L. to test a prominent seismic feature prognosed to be a reef, but which was found to consist of basalt (Gardner, 1972). All wells were plugged and abandoned without shows.

DRILLING RESULTS

Mullet-1 (fig. 3) was drilled to test a stratigraphic play which consisted of Latrobe Group pinchout on Devonian granite, with seal provided by muds of the Lakes Entrance Formation. At 702 m (RKB) the well encountered 36 m of Eocene sand overlying granite. The Eocene sand was overlain by the Lakes Entrance Formation which was sandy at the base.

Bluebone-1 (fig. 4), drilled to test a similar play in a separate Latrobe embayment (fig. 5), encountered 69 m of Latrobe Group silty sand and mudstone overlying granite basement penetrated at 590 m (Curnow, 1969). The sands were poor to moderate reservoir beds, having only moderate porosity and poor permeability.

Sailfish-1 (fig. 6) was drilled to test one of the isolated seismic anomalies believed to be a biohermal reef of Oligocene-Early Miocene age (Gardner, 1972). Carbonates of the Miocene Gippsland Formation were encountered from 260 - 1234 m (no samples were collected above 260 m), and mafic volcanic rocks from 1234 - 1422 m (TD).

STRUCTURAL EVOLUTION

The evolution of the Gippsland Basin is related to movement of the Tasmanian continental block relative to Australia and Antarctica during the late Mesozoic break-up of eastern Gondwanaland (Etheridge *et al.*, 1985).

The thickness of the sedimentary pile on the South Platform is greatly attenuated with respect to the Central Deep, and Palaeozoic basement is relatively shallow (fig. 5). The thickness of the pile increases in a northerly direction towards the Foster Fault.

There was no major rift developed during Cretaceous and Early Tertiary times in the area of the South Platform, which is in contrast to the Central Deep. Small grabens developed along the edge of the shelf, but most of the structuring gave rise to tilted fault blocks dropping basement down to the north-east.

In the Central Deep, the mid-Miocene to Recent phase of folding, related to convergent wrench movements along major faults, was the most significant in generating the northeasterly-trending fold structures which contain the main petroleum fields of the Gippsland Basin (Threlfall *et al.*, 1976). These folds are not well developed on the South Platform and structure is mainly related to basement fault blocks.

Volcanic rocks occur throughout the South Platform. Similar features to that encountered by Sailfish-1 can be seen on numerous other seismic lines.

PROSPECTIVITY

The most prospective unit is the Latrobe Group, which pinches out on the Bassian Rise. Seismic data indicates that there are few structural traps in this part of the Gippsland Basin, and the results of the Sailfish well suggest that some untested seismic anomalies are due to the presence of volcanic rocks (Robertson *et al.*, 1978).

The three wells drilled in the region each tested stratigraphic plays and so there has not yet been a Latrobe test on a structural closure.

The areas south of Sailfish-1 and north of 40°S are areas of thicker Latrobe Group development and of possible interest for future exploration.

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[23 April 1987]

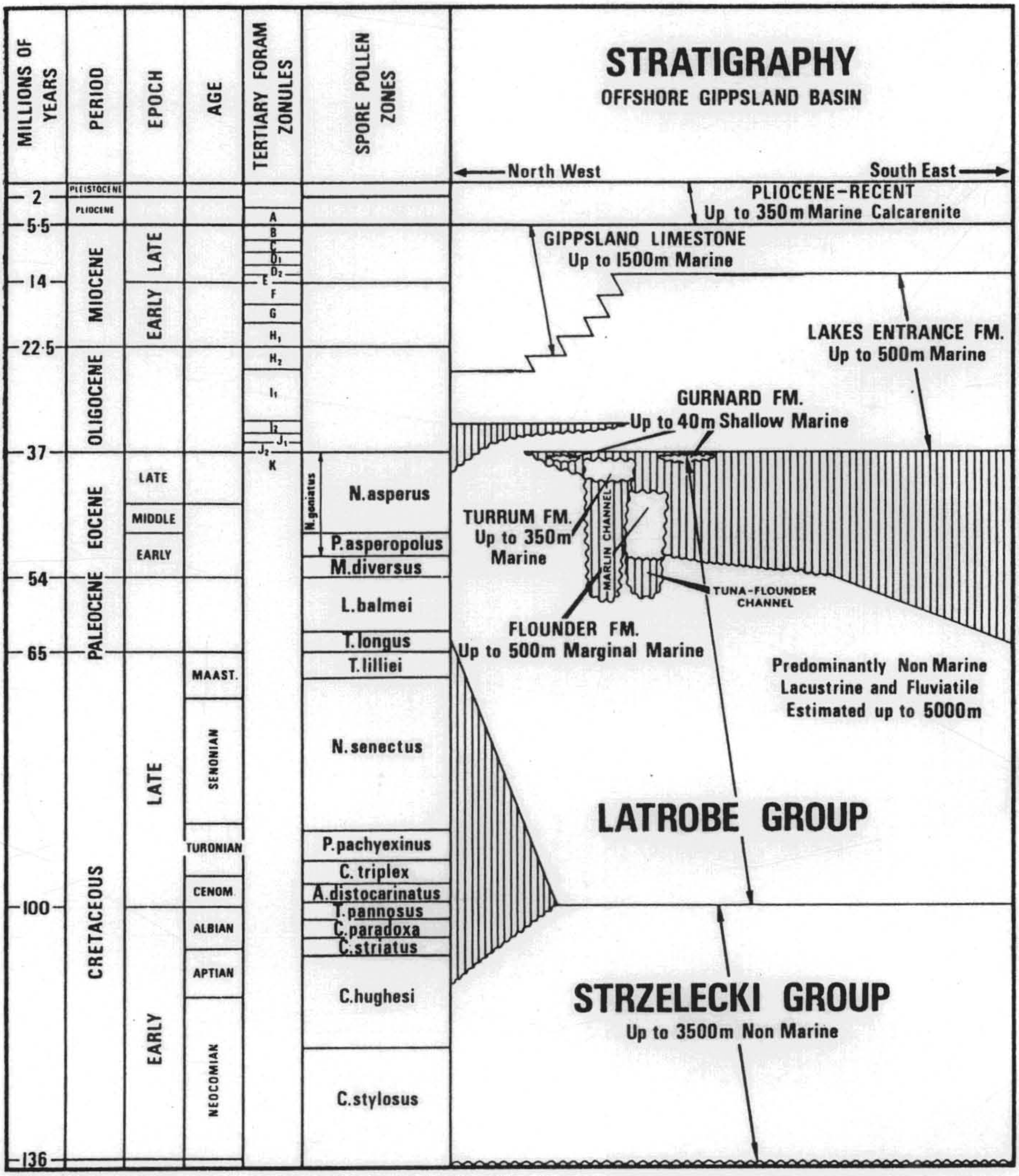


Figure 1. *Offshore Gippsland Basin Stratigraphy (modified after Threlfall et al., 1976).*

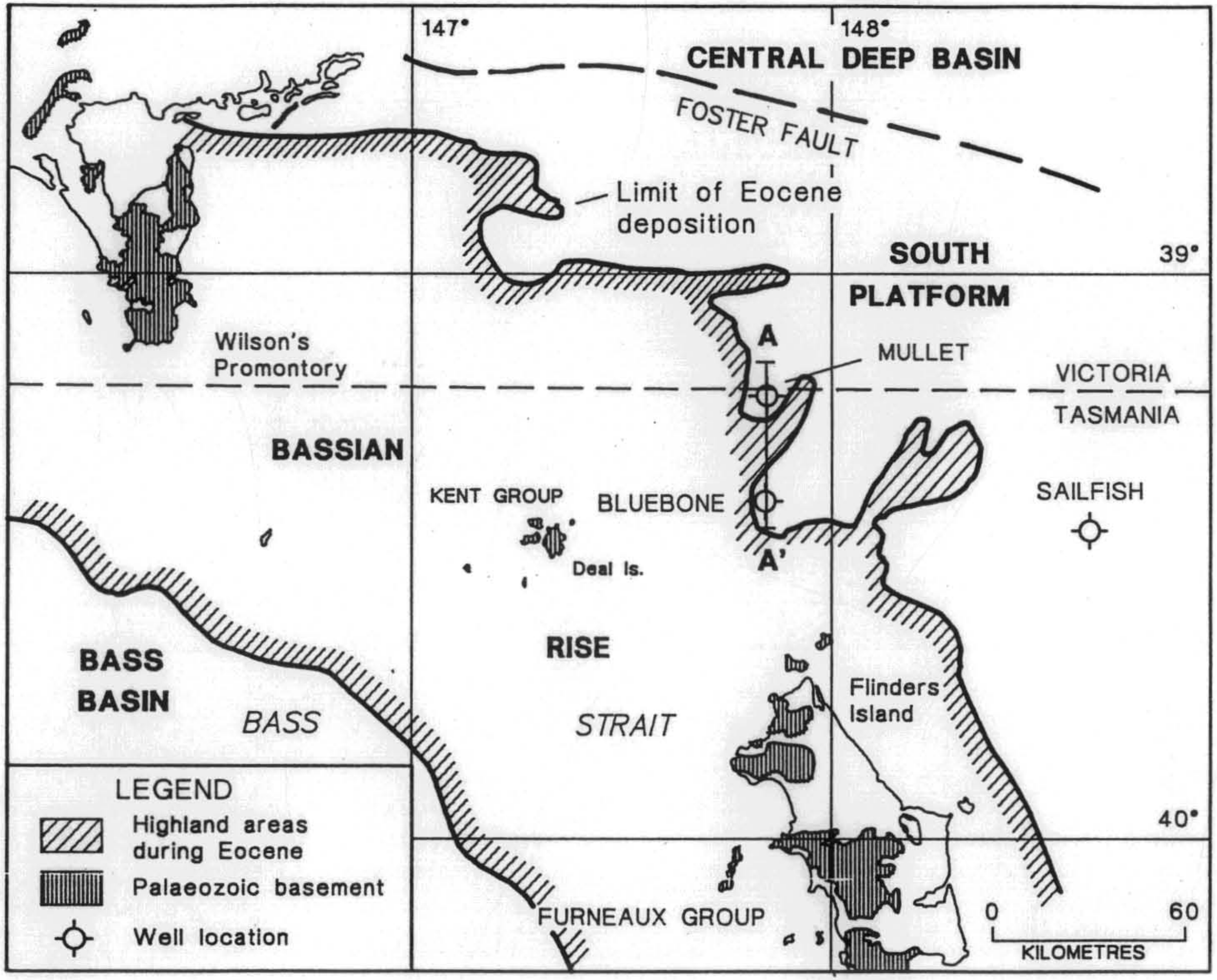
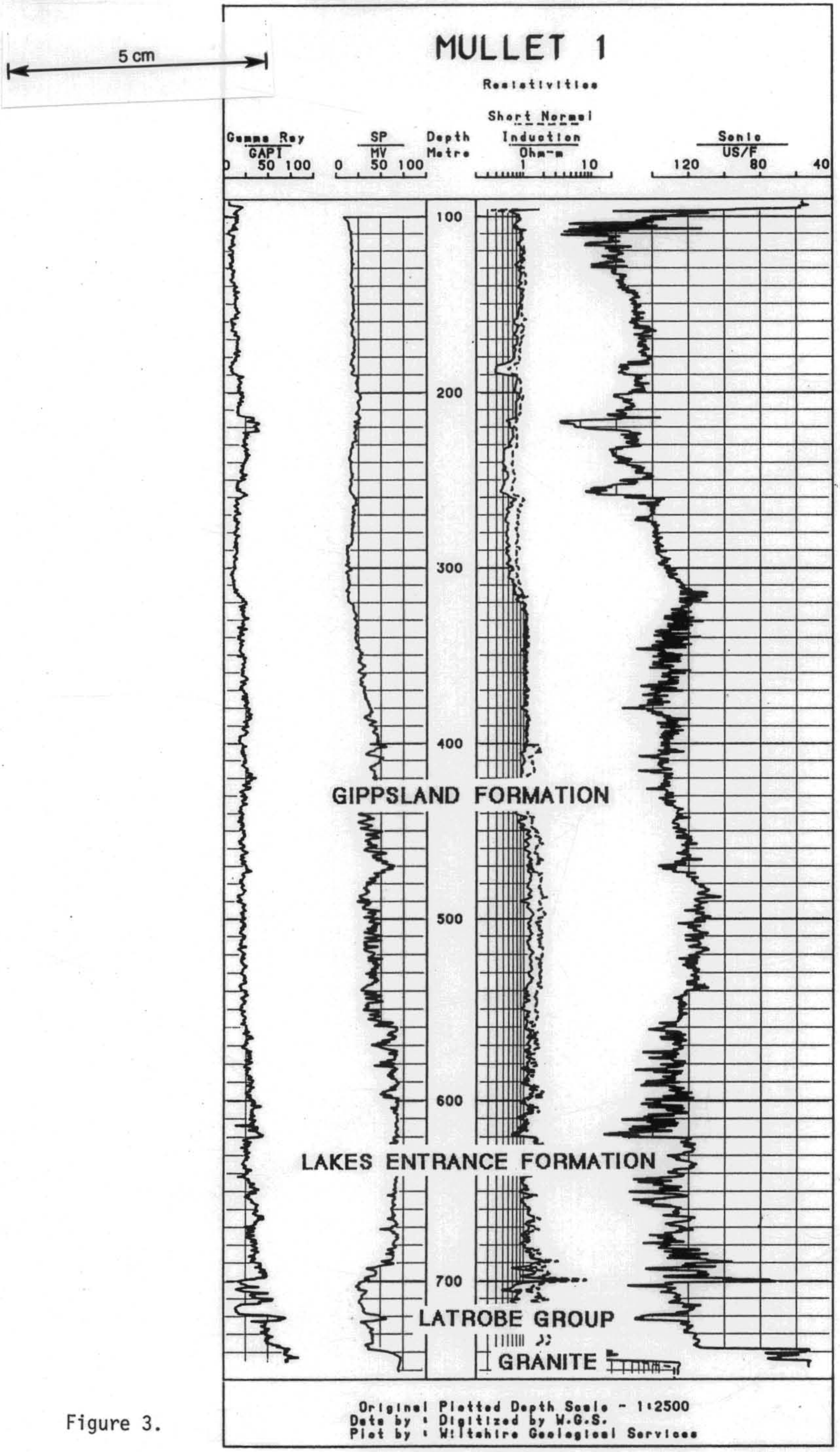


Figure 2. *Locality map (modified after Curnow, 1969).*

5 cm


5 cm
MULLET 1
Resistivities
Short Normal
Gamma Ray
GAPI
0 50 100
SP
MV
0 50 100
Depth
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Induction
Ohm-m
1 10
Sonic
US/F
120 80 40
100
200
300
400
500
600
700
GIPPSLAND FORMATION
LAKES ENTRANCE FORMATION
LATROBE GROUP
GRANITE
Original Plotted Depth Scale - 1:2500
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Plot by : Wiltshire Geological Services

Figure 3.

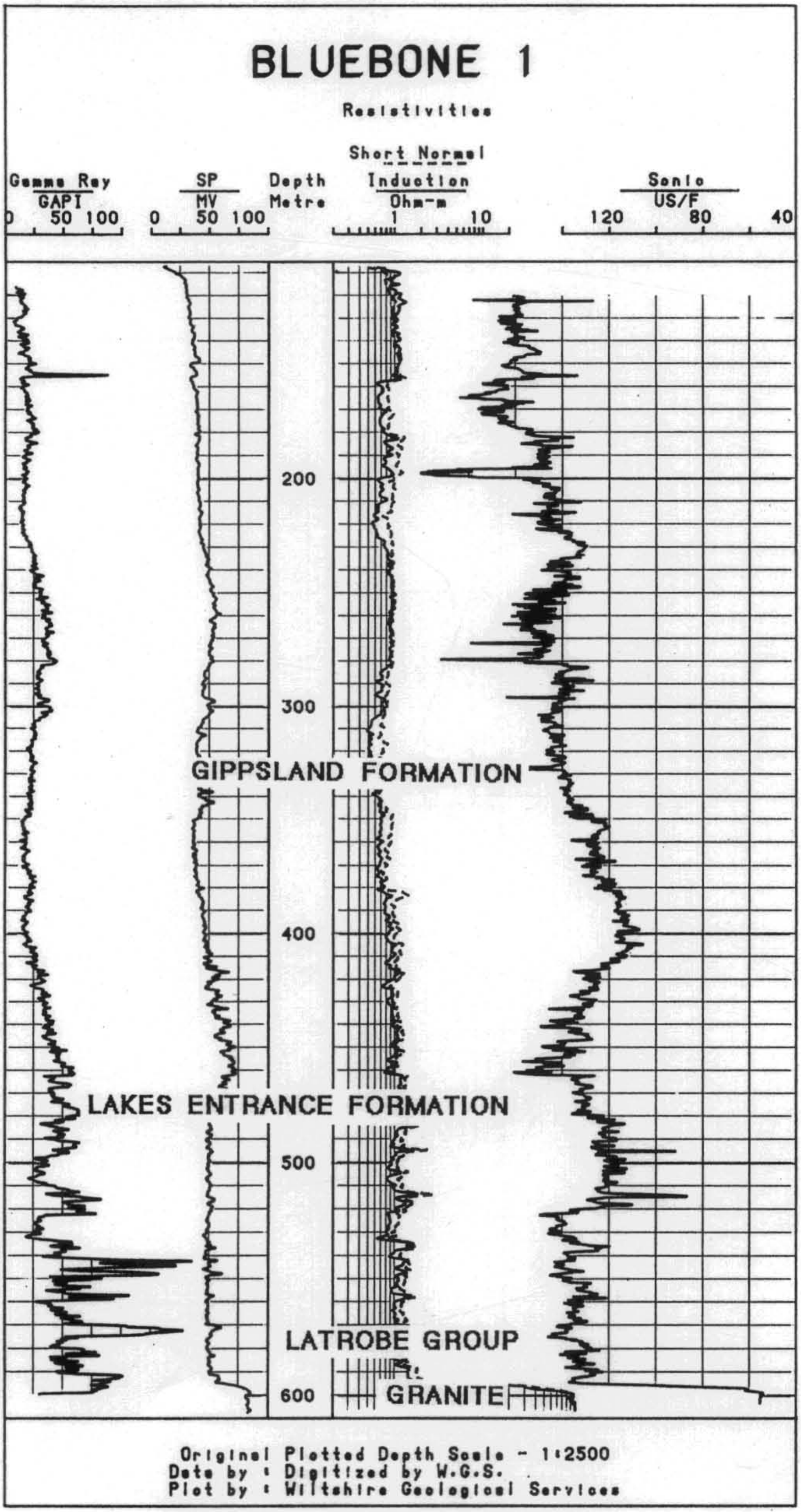
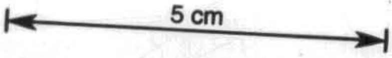


Figure 4. *Wireline logs, Bluebone-1*



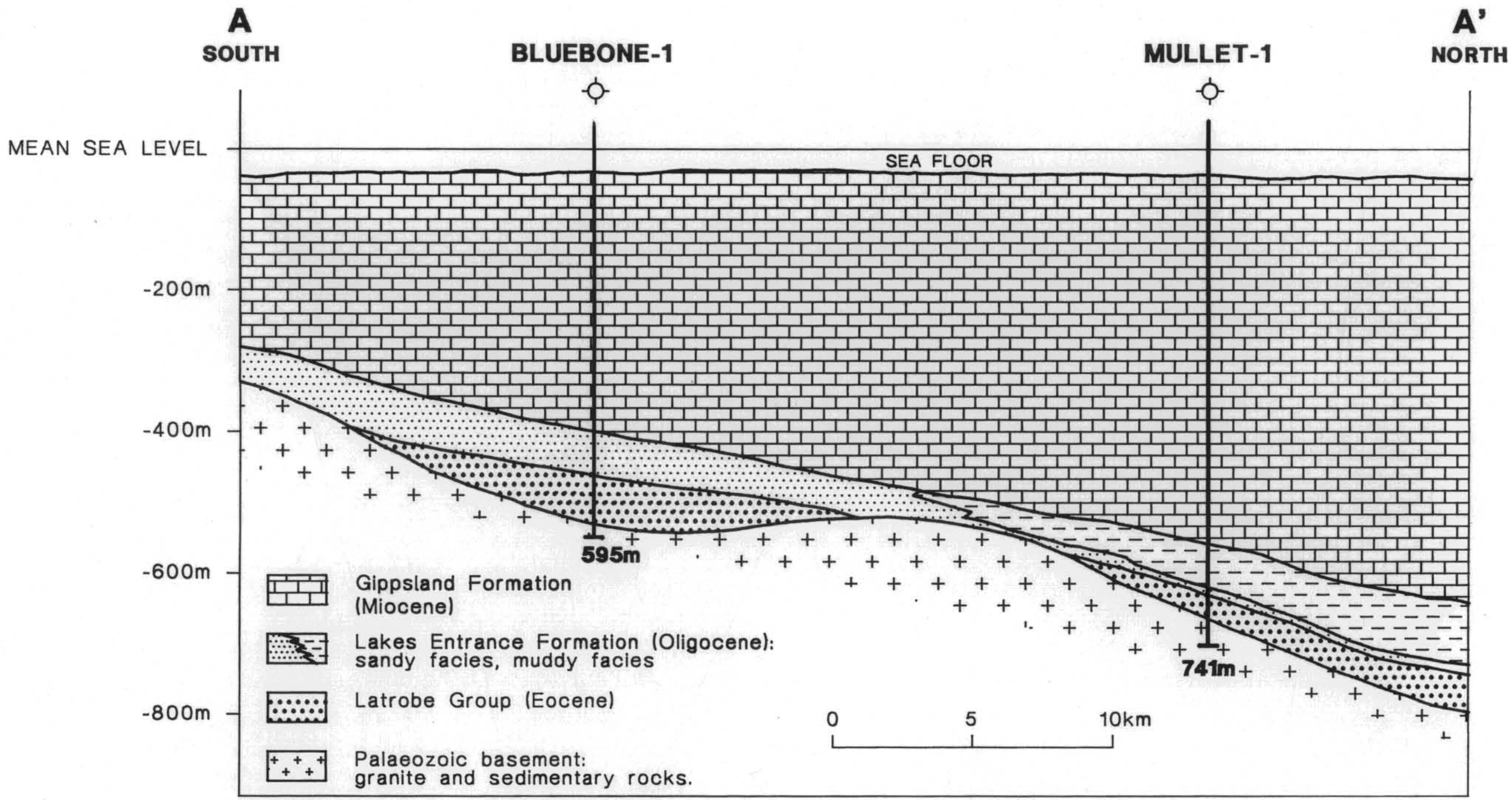


Figure 5. *Geological cross-section, Groper-Mullet trend, Gippsland Basin margin (after Curnow, 1969).*

5 cm

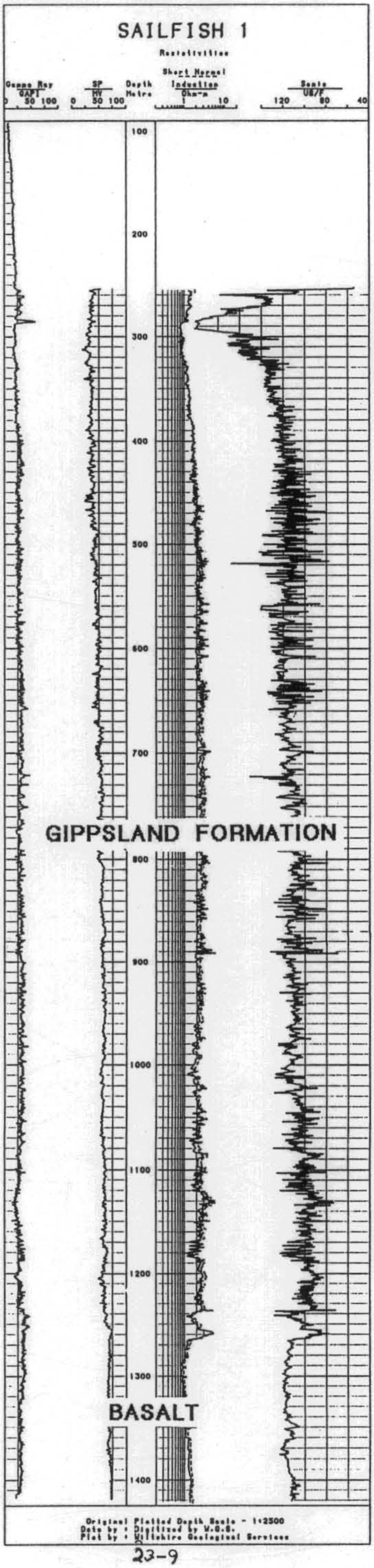


Figure 6. *Wireline logs, Sailfish-1*