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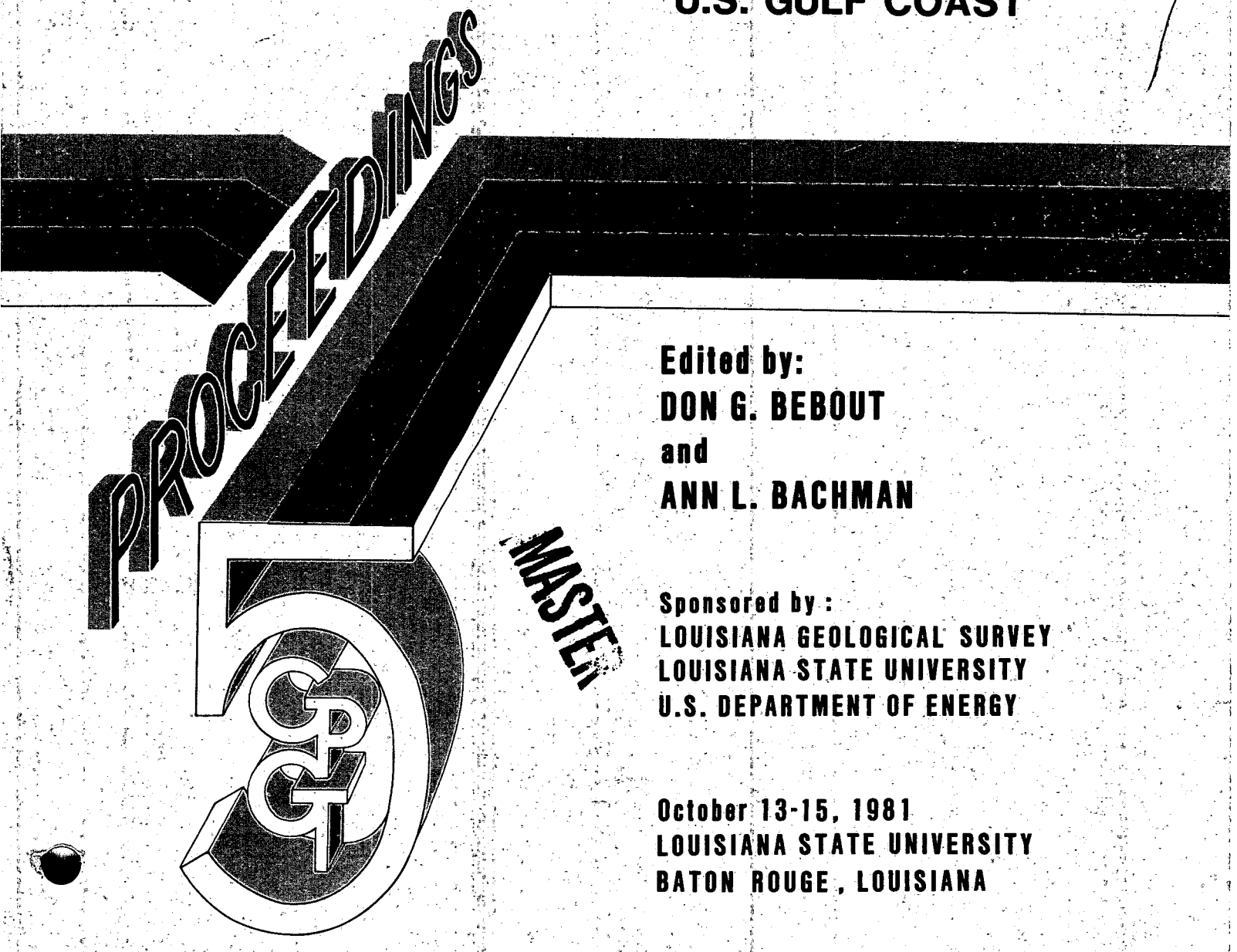

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DON G. BEBOUT
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STRUCTURAL-STRATIGRAPHIC SETTING OF SOUTH FRESHWATER BAYOU PROSPECT, VERMILION PARISH, LOUISIANA

Thomas Cavanagh* and Rex H. Pilger, Jr.
Department of Geology, Louisiana State University

*Present address: Exxon Company, USA, Houston, TX 77001

ABSTRACT

The primary reservoir targets in South Freshwater Bayou Prospect are sands whose deposition appears to have been structurally controlled. The growth of a deep domal feature localized deepwater sand deposition on its flanks, thereby producing a significant thickness of subsequently geopressured sandstone. The area is, therefore, not only prospective in its own right, but provides an exploration model for other geopressured-geothermal prospects.

INTRODUCTION

As part of Department of Energy sponsored site-specific studies of selected geopressured-geothermal prospects by the LSU Department of Geology (DOE Contract No. DE-AC08-79ET27019), a report on South Freshwater Bayou Prospect has been prepared (Cavanagh, 1981). This note summarizes salient aspects of the study, the most important of which are (1) specific definition of the South Freshwater Bayou area as a significant prospect and (2), more generally, development of a model of geopressured reservoir development which may have predictive value in the search for other prospects. For specific details concerning the resource potential of the prospect the report by Cavanagh (1981) and an earlier report by Bassiouni (1978) should be consulted.

STRUCTURAL-STRATIGRAPHIC SETTING

South Freshwater Bayou Prospect is located in Vermilion Parish, Louisiana, in T16-17S, R1W-2E, and offshore lease blocks 3-9 and 12-18 (Fig. 1). The prospect exists within the limits of Southeast Pecan Island Prospect as defined by Bassiouni (1978), but has been defined separately since a proposed design well would be located in a substantially different position from that proposed by Bassiouni. Stratigraphically, the prospect interval consists of sedimentary rocks from Lower Miocene to upper Middle Miocene (biostratigraphic zones Upper Planulina to Texulari stapperi. The rock sequence consists of the familiar dominantly regressive basin-filling succession characteristic of the northern Gulf Coast continental margin basin. The sequence consists of (1) bathyal to outer neritic, largely fine-grained deposits, (2) overlying middle to inner neritic fine-medium-grained clastics, and (3) uppermost, deltaic to continental clastics. Coarse-grained clastics occurring within the lowermost facies 1 most likely represent deep-water sedimentation by turbidity currents or grain-flow processes. These deeper sandstones and some of the sandstone beds within the middle facies 2 generally represent the target reservoirs in geopressured-geothermal prospecting. The deeper sands appear to be uniformly geopressured, as they are generally encased in finer-grained impermeable deposits. Sandstones within the middle facies are variably pressured, apparently depending on the degree of isolation of particular sandstones from hydropressured sands higher in the section, as controlled by (a) the geometry of diachronous fine-grained deposits which are necessary to the existence of a seal and (b) the proximity to faults which may serve as conduits for vertical movement of fluids.

The deepest units, as recognized from both well and reflection seismic data, record the development of a northeast-southwest trending ridge, presumably salt-cored. This feature, Pecan Island ridge, influenced sedimentation through Gyroidina vicksburgensis time. Significant sand development occurred on the flanks of the ridge--sands which presently form the target reservoirs in South Freshwater Bayou prospect. Uplift of the ridge was accompanied by movement on fault A (Fig. 1-3) across which growth of the section occurred. Following cessation of growth of Pecan Island ridge, a series of minor incomplete transgressive/regressive sequences form additional target reservoirs in the prospect.

Complex faulting patterns developed during the pre- and syn- delta stages of sedimentation in the prospect. The mapped faults (Fig. 1), provide conservative limits on the size of potential reservoirs. Little fault movement occurred after Cibicides Opima time, reflecting near completion of the unstable part of the basin filling process in the prospect area.

A MODEL FOR GEOPRESSURED RESERVOIR DEVELOPMENT

Among the desired attributes of a geopressured-geothermal prospect is the presence of thick-laterally extensive sandstones adequately sealed within impermeable shales. Considering depositional environments in the Gulf Coast, such shale-encased sands are likely to be deposited either in a deltaic environment within a regressive-transgressive sequence or in a deep water environment by turbidity currents or grain-flow processes.

Thick continuous sand deposition is most likely to occur within the deltaic environment rather than under deep water conditions, in the absence of structural disturbances. The processes of submarine turbidite fan deposition are such that loci of sand deposition within distributary channels are likely to shift frequently, precluding significant vertical accumulation or lateral continuity of sands.

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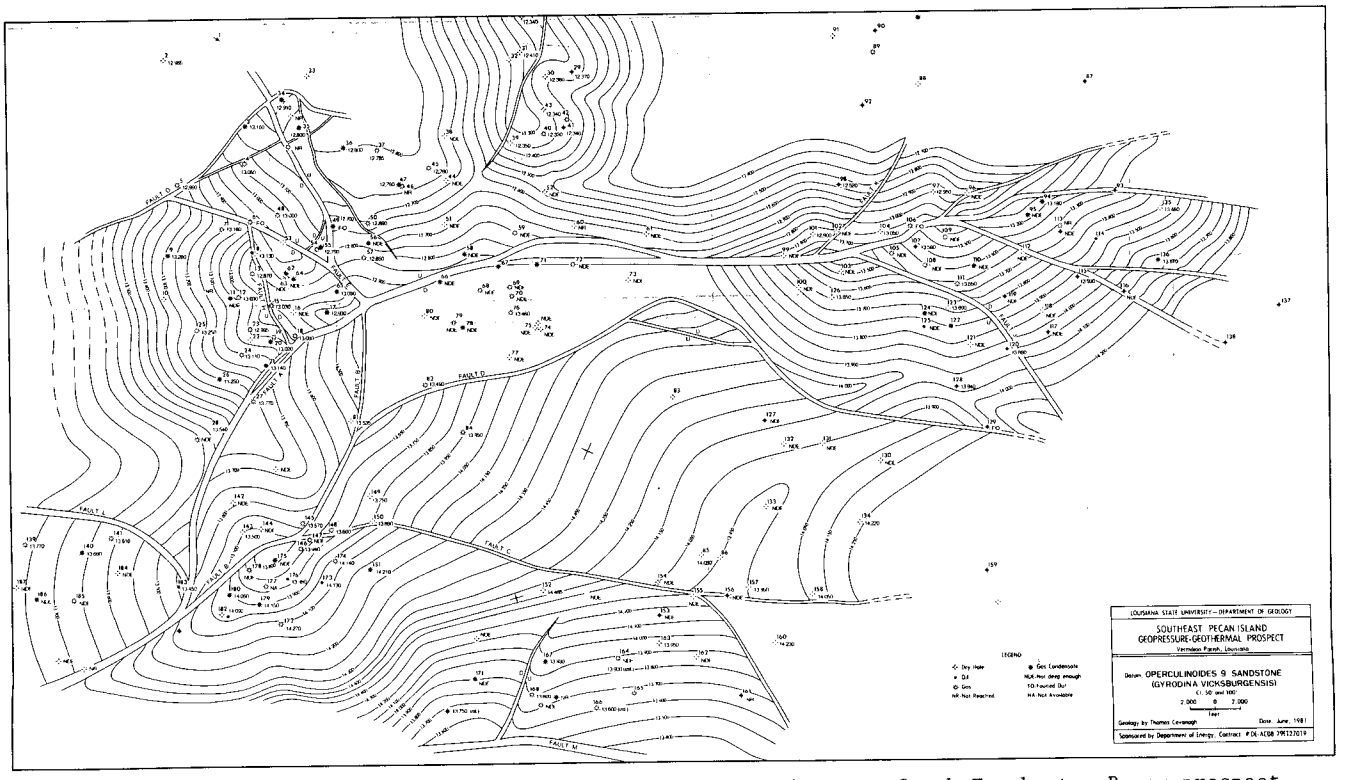

Figure 1. Structural contour map on Operculinoides 9 Sandstone. South Freshwater Bayou prospect is centered in the north half of T17S-R2E. All figures are from Cavanagh (1981).

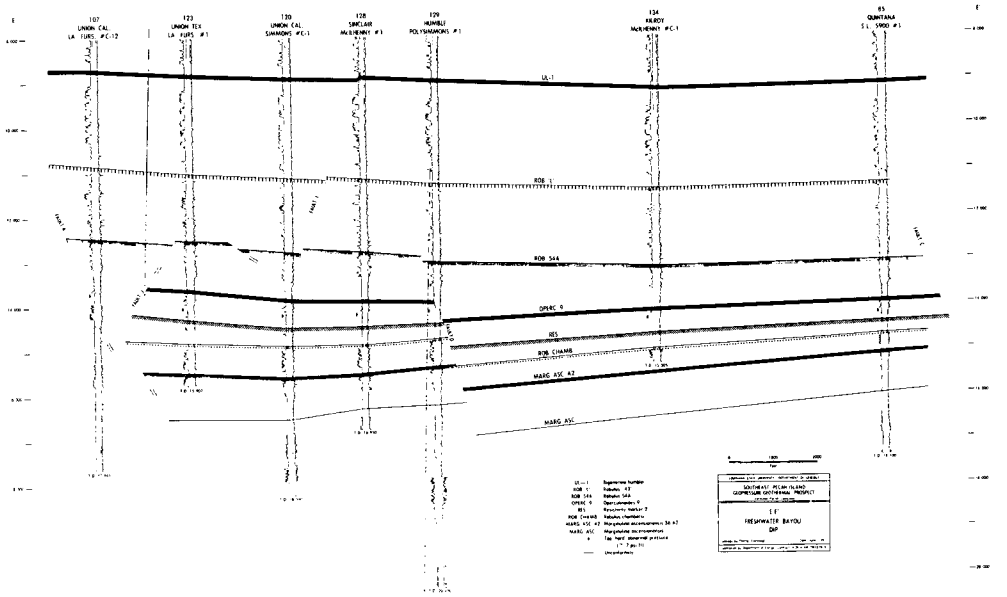

Figure 2. Section across South Freshwater Bayou Prospect. Sandstone below Robulus Chambersi horizon form prospective reservoir.

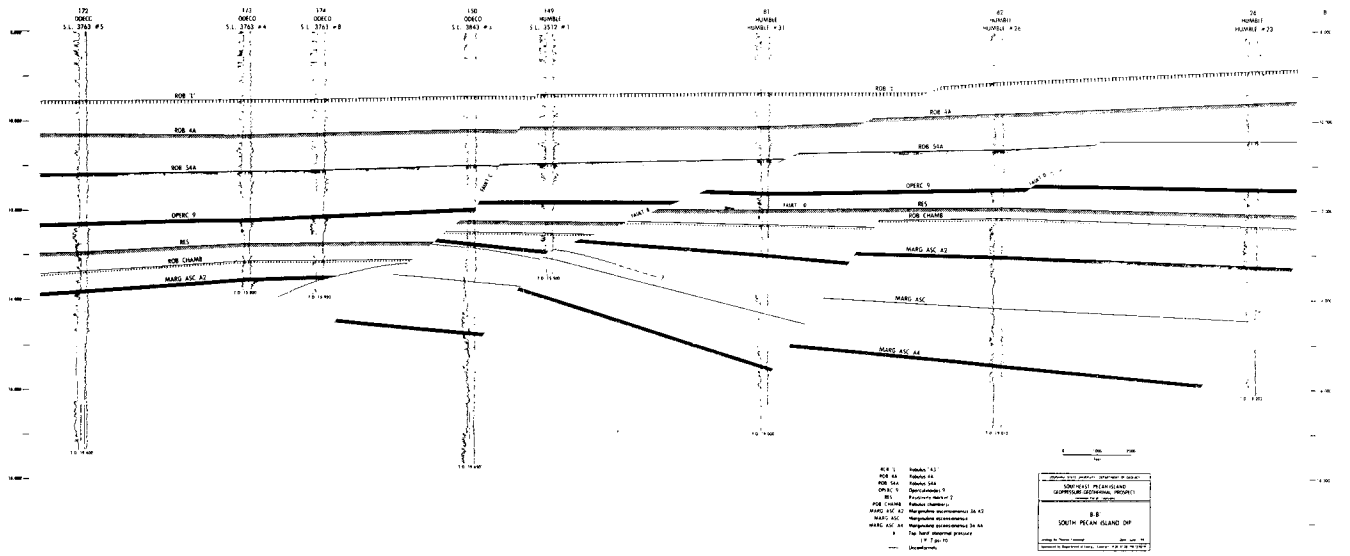

Figure 3. Strike section across Southeast Pecan Island Prospect.

However, submarine structural growth due to a salt dome (such as Pecan Island ridge) or shale diapir will tend to produce adjacent withdrawal regions which can serve as loci of preferred turbidite sand deposition. Lateral and vertical continuity of sands is more likely in the presence of such structural control.

Other desired attributes for geopressured-goethermal reservoir need to be analyzed in the context of the structural-stratigraphic model outlined here. However, it seems worthwhile to predict that a desirable prospect type might typically record the syn-depositional structural-growth sequence recorded in Freshwater Bayou Prospect.

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