"AFRICAN" PALEOZIC SEDIMENTARY ROCKS

OF THE WEST SUWANNEE BASIN

FLORIDA, ALABAMA AND GEORGIA

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ABSTRACT

The Paleozoic West Suwannee Basin is located mostly in Panhandle Florida. It is an asymmetrical basin with a deep to the northeast. The Paleozoic terrane was extensively block-faulted, a condition also found in the East Suwannee Basin and the West African Bove Basin. Clastics deposited in the West Suwannee Basin consist of conglomerates, quartzites, sandstones and shales. Paleontologic dates from cores range from Lower Ordovician to Devonian. The West Suwannee Basin possibly connected to the East Suwannee Basin in Peninsular Florida, where similar Paleozoic lithologies occur. The connection, if present, is now covered by Triassic red beds which have not been fully penetrated.

ACKNOWLEDGEMENTS

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Last, but not least, this paper would not have made it through the numerous revisions were it not for the patient word processing of my wife Mary.

INTRODUCTION

There has been no modern regional analysis of the "African" Paleozoic rocks in the Florida Panhandle since 1952. This paper is presented to fill that informational gap.

The known extent of the West Suwannee Basin is confined to central Panhandle Florida with a small extension into southeastern Alabama and southwestern Georgia.

In the preparation of several regional Jurassic-Cretaceous stratigraphic studies, I have examined the basal section of ALL wildcat wells drilled in the Panhandle up to 1991 which reached the basal Jurassic section; the wells included in this paper are the only ones to encounter "African" Paleozoic rocks.

Well numbers under 20 are used to identify wells which penetrated Paleozoic sedimentary rocks. Letters A, B, and C are outside Florida. Numbers in the hundreds (and Well D) identify ancillary control wells which did not penetrate Paleozoic sedimentary rocks.

PREVIOUS INVESTIGATIONS

Only a few papers present data on the Paleozoic rocks of the West Suwannee Basin. The pioneer work was done by Applin (1951) and by Bridge and Berdan (1952) who presented lithologic summaries. Paleontological determinations from Wells 9, A, and B were made by Bridge and Berdan from cores. They noted at the time, long before continental drift acquired respectability, that the flora and fauna in these wells were related to the biota of West Africa, and not at all to that of the North American Paleozoic.

Arden (1974) presented a north-south seismic profile (Fig. 2) and commented on the probable age of the rocks. The beds he originally assigned to the Triassic he now assigns to the Devonian (pers. comm.).

Comments and age data on Well A in Alabama are presented by Nethery and Thomas (1975) and Gutherie and Raymond (in preparation).

Pojeta et al (1976) and McLaughlin (1970) present paleontologic data from cores taken in Well B.

The Suwannee Basin was named by Braunstein (1957).

STRUCTURE

The West Suwannee Basin is bounded on the south by the Gaskin[1] granitic batholith and to the northeast by the Fox Creek[2] granitic batholith. The northern limit (as well as the Devonian suture between North America and Gondwana) is buried beneath deep Triassic basin fill in Alabama.

The fill in the Western Triassic Graben (Santa Rosa County) conceals the western limit, and the fill in the Eastern Triassic Graben (east of Liberty County) conceals the possible connection to similar Paleozoic rocks in Peninsular Florida. The occurrence of granite in Well 120 (Fig. 1) suggests the possibility that the West Suwannee Basin does <u>not</u> now connect with the East Suwannee Basin.

The West Suwannee Basin appears to have originally been asymetrical with the deep centered in the northeast corner (Fig. 1). An east-west proprietary seismic profile north of Well 4 showed dip to the east. Dip appears to have originally been quite low over the western half of the basin, as indicated

[1] The type well for the Gaskin granite is the Hunt 1 International Paper (P 746, map 118), 30-3S-11W Gulf County Florida. The type interval is 12900-13277 feet TD E-log (12880-13284 feet TD samples). It is dated in the type well by proprietary radiometrics as 650-750 my (Proterozoic). The granite is named from the Gaskin Wild Life Management Area in which the type well is located.

[2] The type well for the Fox Creek granite is the Zilka 15-3 Leonard (P 1235, map 119), 15-2N-8W Calhoun County Florida. The type interval is 8000-9758 feet TD E-log (7950-9755 feet TD samples). The unit is named from a creek in the same Section as the type well. No radiometric dates are available for the Fox Creek granite, but its proximity to the Gaskin Batholith implies a similar age.

by the presence there of a large area of the same basal Lower Ordovician conglomeratic facies (Fig. 1).

The dip steepens in the eastern part of the basin where Silurian and Devonian rocks wedge in. Here a Paleozoic section of several thousand feet abuts the Fox Creek Batholith (Fig. 1). Paleozoic sediments may have onlapped the batholith in the Lower Ordovician and then been downfaulted to form the deep basin, with any Paleozoic rock present on the batholith subsequently eroded.

Between Wells B and C, proprietary seismic data show moderately steep dip. In Well B, Devonian rocks are present but in Well C, some 8 miles to the north, only basal Lower Ordovician rocks are present indicating a loss of several thousand feet of section. The Lower Ordovician rocks in Well C rest on the Proterozoic Mauritanid low-grade metamorphic volcanic complex (Fig. 3) (Winston 1992). These metamorphics probably represent the country rock into which the Fox Creek and Gaskin granitic batholiths were intruded.

The Paleozoic sedimentary terrane was extensively block-faulted, as shown by Arden's profile (Fig. 2) and personal communication with those in possession of proprietary seismic data. In the West African Bove Basin (Fig. 3), block faulting is also pervasive (Figs. 4 and 5). The presence of this type of faulting on both sides of the Atlantic suggests that it occurred either before or during the rifting associated with the break-up of Pangea. Proprietary seismic data show the faults in the Panhandle to be about 6 miles apart and the blocks tilted.

Today the eroded surface Paleozoic terrane exhibits a general southwest dip (Fig. 6) with two prominent noses centering in Holmes and Bay Counties. Cross-sections in Figures 7, 8, and 9 (Index map Fig. 10) show present-day structure; diagrammatic reconstructions of the Basin's original attitude follow the same cross-section lines.

STRATIGRAPHY

General

In the West Suwannee Basin 15 wells reached "African" Paleozoic rocks; of these, 2 were 1000-foot offsets to Well B.

A 1630-foot Paleozoic section was completely penetrated in Well C, near the updip limit in Georgia. The maximum incomplete penetration was 3103 feet in Well 8.

Well 9 was the first to penetrate this section in 1948; the latest was Well 1 in 1990.

Well 113 penetrated 11 feet of Pre-Jurassic rock; the poor quality of the drill cuttings and the shallow penetration left the character of the rock in doubt. It has been variously described as granite, rhyolite and granite wash. Being very close to the Paleozoic pinch-out, it could be an Early Paleozoic basal conglomerate composed of granite and rhyolite debris from the hinterland.

By adding the penetrated thickness of the Lower Ordovician in Well C (1635 feet), Devonian in Well 9 (796 feet), the Silurian-Ordovician in Well 8 (3103+ feet, Fig. 12) a minimum of 5500 feet of Paleozoic rock must be present. This equals the greatest actual full penetration in the Eastern Suwannee Basin of northern Peninsular Florida.

Lithology

There are 4 basic lithologic types, all clastic (Fig. 1). These are:

1. Quartzitic conglomerate and very coarse grain quartzitic sandstone.
2. Sandstone, very fine to coarse grain and quartzitic, with thick interbeds of black to dark gray shale.
3. Siltstone and very fine grain sandstone.
4. Red, green and black shale.

In a 35-mile wide zone back from the Triassic grabens, diabase intrusions are usually present in Paleozoic sedimentary rocks.

Type 1 lithology (Wells 1,2,3,4,5,6,7 and C) is composed of conglomerate and coarse to very coarse, quartzitic sandstone. Occasionally very fine to fine grain sandstones and mica may be present. Colors are predominately white and pink, with occasional reds and greens, and rare grays and purples. Exotic grains include rhyolite, granite-derived red, pink and orange grains and pink feldspar. Unusual constituents present in these beds include red shale grains, gray shale inclusions, and a conglomerate with a matrix of red and pale green sandstone.

The rare shales are red streaked with green, and are usually micaceous and sandy.

Type 2 lithology (Well 8) consists of fine to medium grain sandstone, usually very micaceous and interbedded with dark shales. Sandstone colors are generally white, pink and dark gray, with occasional lavenders. Siltstone when present is gray, micaceous and quartzitic. Quartzite is common and is fine to medium grain, with occasional conglomeratic beds. Colors are white and pink; orange granite-derived grains are occasionally present.

Interbedded shale is common and is usually black or dark gray, but may occasionally be pale green; it is frequently silty and micaceous.

Type 3 lithology (Wells, 10, 8 and A) consists of siltstone and very fine grain sandstone. Gray shale inclusions and micastone are present in the arenites.

Shale interbeds are black, dark gray, red, and are frequently micaceous.

In Well A, a long core encountered two thin limestone beds, the only occurrence so far of limestone in the Paleozoic rocks of Florida. The limestone is micritic and dark brown with a crystalline structure.

Type 4 lithology (Wells 9 and B) consists almost exclusively of shale. These shales are red mottled with green, maroon and dark gray. In Well B, a porous, fine grain white sandstone was encountered at the bottom of the well. Offsets 1000 feet to the east and west encountered non-porous quartzitic sandstone in the same interval.

Age

Paleontologic dates were obtained from cores. Bridge and Berdan (1952) date the shales in Well A as Lower Ordovician. Their paleontologic data from Well B indicated a Silurian or Ordovician age; however, more recent paleontologic investigations (Pojeta et al 1976) date the shales in Well B as Devonian. The predominance of gray shale, in conjunction with the porous

sandstone in this well, agree with descriptions of the Devonian in Algeria. The lithologic sequence in Well B is unique in the Florida Paleozoic.

The red and green shales in Well 9 were dated as Devonian by Bridge and Berdan from plant remains. These could be younger than the varicolored Devonian shales in the upper part of the section in Well B. The plant remains suggest a final terrestrial or lacustran deposition after the collision of North America and Gondwana had destroyed the Iapatus Sea.

GEOLOGIC HISTORY

Until the Late Triassic, Panhandle Florida was part of West Africa. There Middle and Late Proterozoic clastic sediments were deposited; simultaneously, multiple volcanic events produced rhyolites. In the Late Proterozoic, the sediments and volcanics (Mauritanid Complex, Fig. 3) were mildly metamorphosed (Villeneuve 1984). These rocks were then subjected to erosion.

In the Panhandle this metamorphic terrane was intruded by the Gaskin and Fox Creek granitic plutons in the Late Proterozoic (Figs. 1 and 6).

"African" Paleozoic clastic sediments were deposited on the metamorphics and possibly the granite from Lower Ordovician (possibly Late Cambrian) into the Devonian. In the Late Devonian, following the collision of North America and Gondwana to form Pangea, deposition ceased; the only remaining Paleozoic geologic process was erosion.

During the rifting of North America from Pangea in the Late Triassic, the northern, western and probably the eastern portions of the West Suwannee Basin were down-faulted and covered by Triassic red beds. In the early Jurassic, diabase intruded the Paleozoic sedimentary rocks near the grabens as well as the sediments in the Triassic grabens.

After further erosion during the Lower and Middle Jurassic, the Late Jurassic marine transgression covered the entire Paleozoic-Proterozoic surface.

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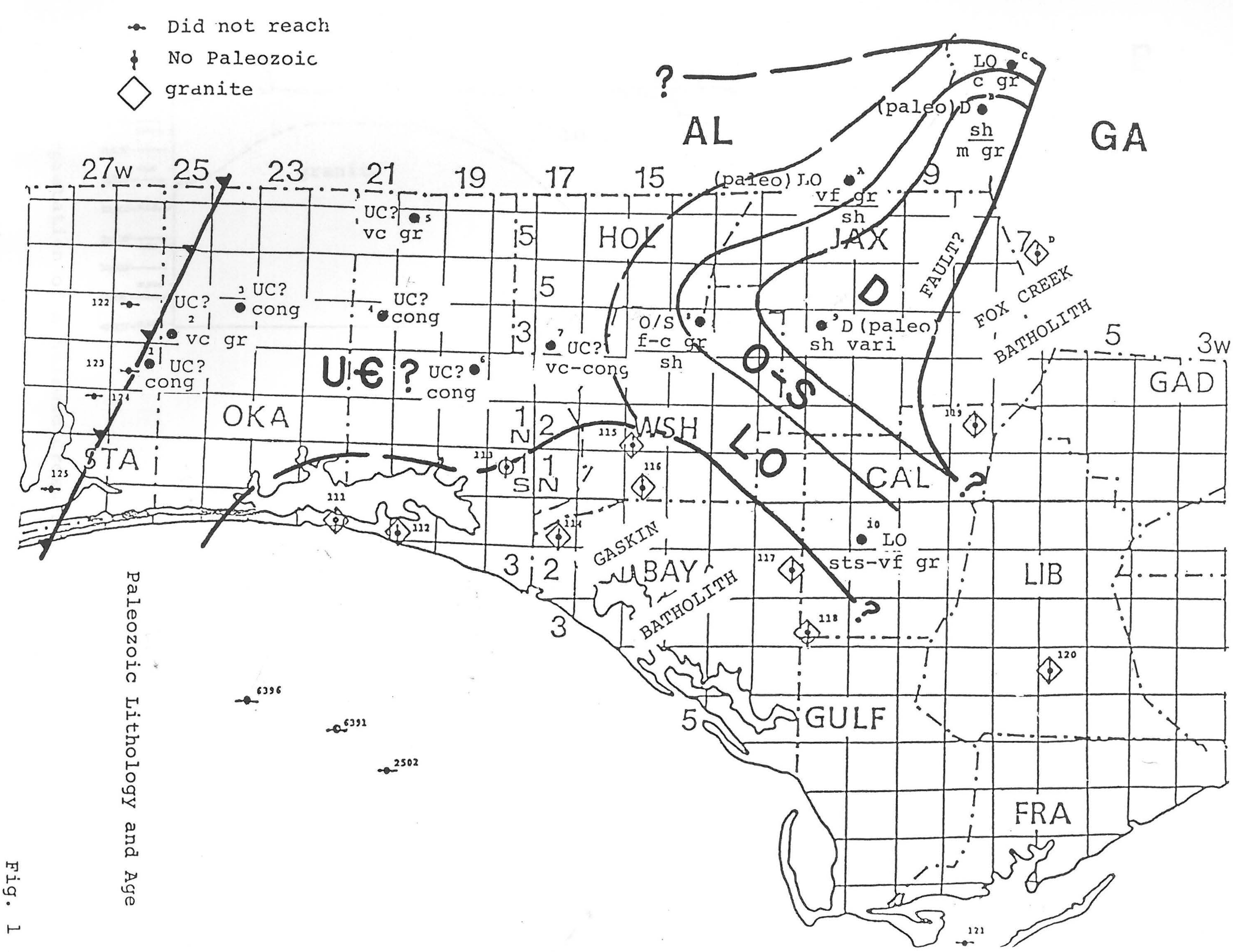
Table 1

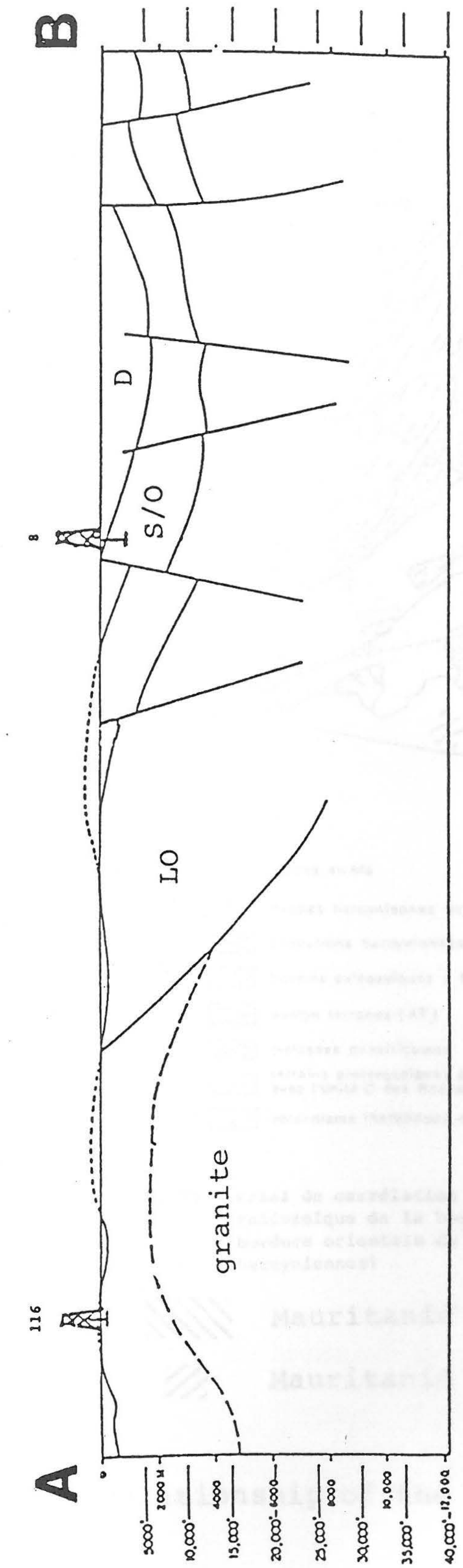
WELL LIST

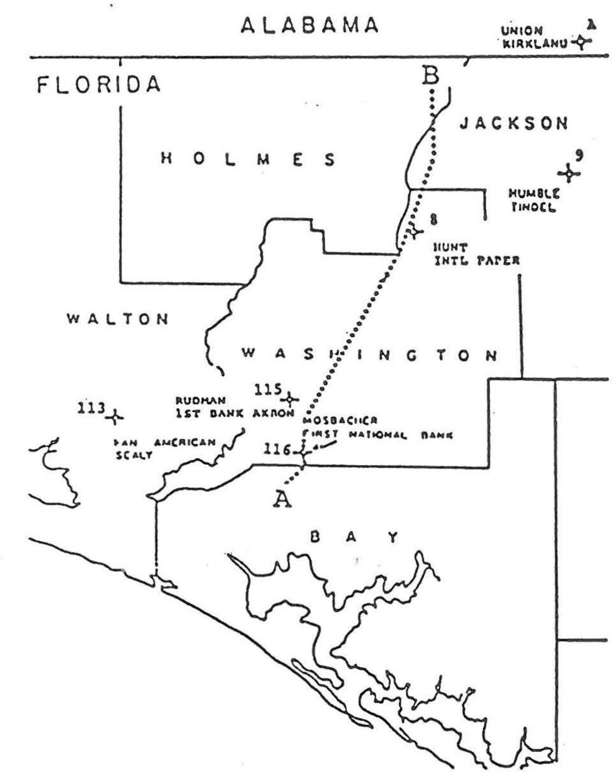
Map No.	State No.	Operator	Well	Penetration
		PALEOZOIC		
1	1254	First Energy	13-2 Champion	54+
2	1105	Tenneco	31-3 State	136+
3	590	Sonat	1 Moore	420+
4	519	Coastal	1 Belcher	20+
5	587	Texas Gas	1 Intl Paper	468+
6	612	McCulloch	1 Indian Creek	118+
7	716	Sonat	32-4 Hughes	916+
8	738	Hunt	1 Intl Paper	3103+
9	94	Humble	1 Tindel	796+
10	777	Hunt	31-2 Intl Paper	216+
A	186	Union	1 Kirkland	540+
B	GGS 121	Warren	1 Chandler	700+
C	GGS 3543	Exxon	1 Wilson	$\boxed{1630}$
		NO PALEOZOIC		
111	970	Goldking	1 Sims	
112	721	Charter	4 St Joe	
113	268	Pan Am	1 Sealy	
114	690	Charter	2 St Joe	granite
115	644	Rudman	31-2 First Bank	
116	549	Mosbacher	1 First Bank	
117	1010	HOM	13-3 SW Forest	
118	746	Hunt	30-4 Intl Paper	
119	1235	Zilka	15-3 Leonard	
120	745	Placid	16-3 USA	
D	GGS 3001	Dunlap	1 Saunders	
		DID NOT REACH		
121	397	Mobil	1 State 224A	
122	534	Phillips	1 St Regis B	
123	911	Pennzoil	5-2 FL Forest	
124	1097	Getty	1 State	



Paleozoic Lithology and Age

Fig. 1

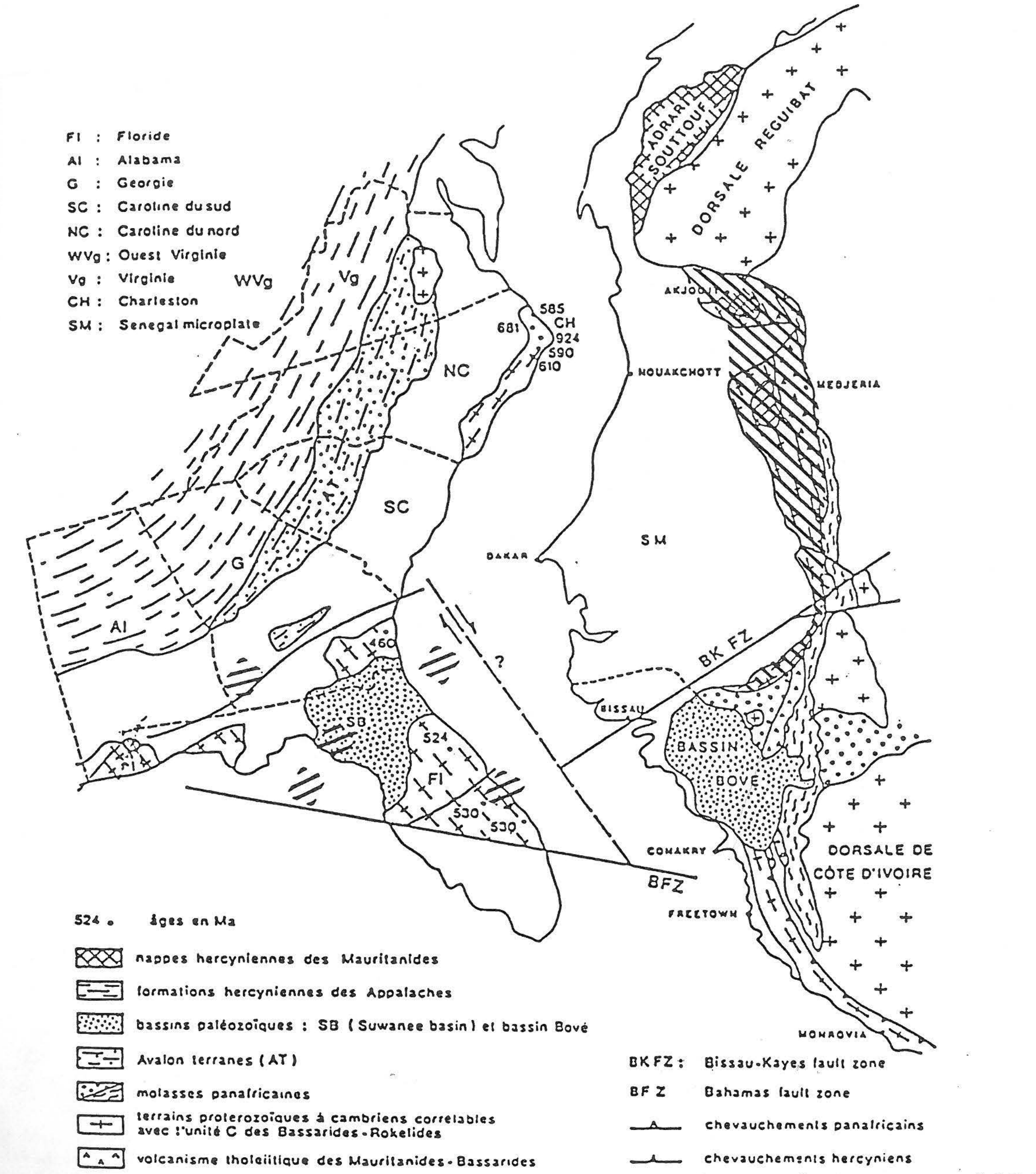




after Arden 1974

Interpretation of a Seismic Cross-Section in Panhandle Florida

Fig. 2



after Villeneuve 1984

Fig.204 - Essai de corrélation entre les formations du Précambrien supérieur et du Paléozoïque de la bordure occidentale de l'Afrique de l'Ouest et de la bordure orientale de l'Amérique du Nord (chaînes du Précambrien supérieur et hercyniennes)

Mauritanid suite in Africa

Mauritanid suite in SE U.S.

Relationship of the geology of West Africa and Florida

Fig. 3

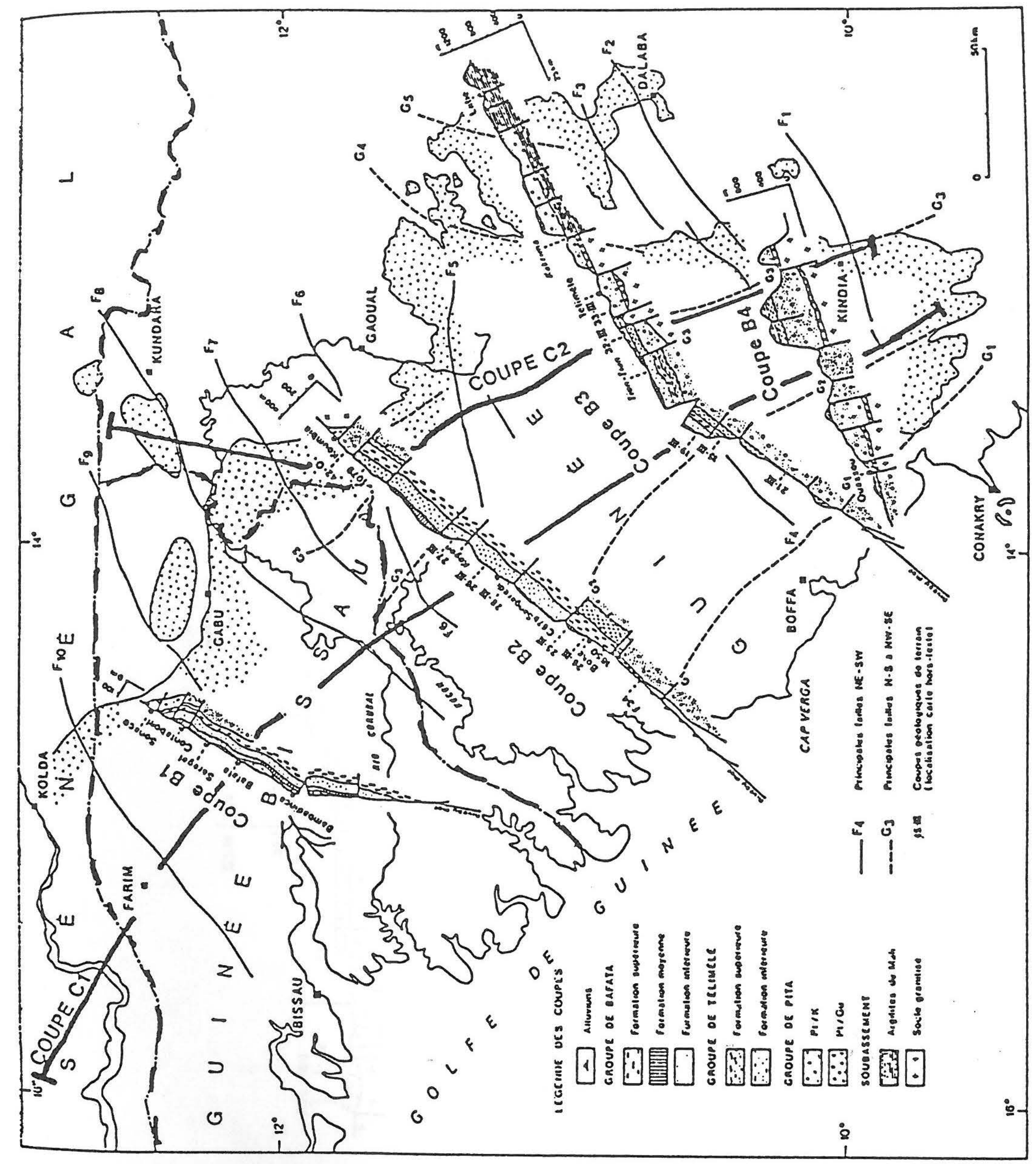


Fig. 178 : Coupes géologiques transversales dans le bassin Bové.

after Villeneuve 1984

Bove Basin Cross-sections B1, B2, B3, & B4

Index for Cross-sections C1 & C2

Fig. 4

Bove Basin Cross-sections C1 & C2

after Villeneuve 1984

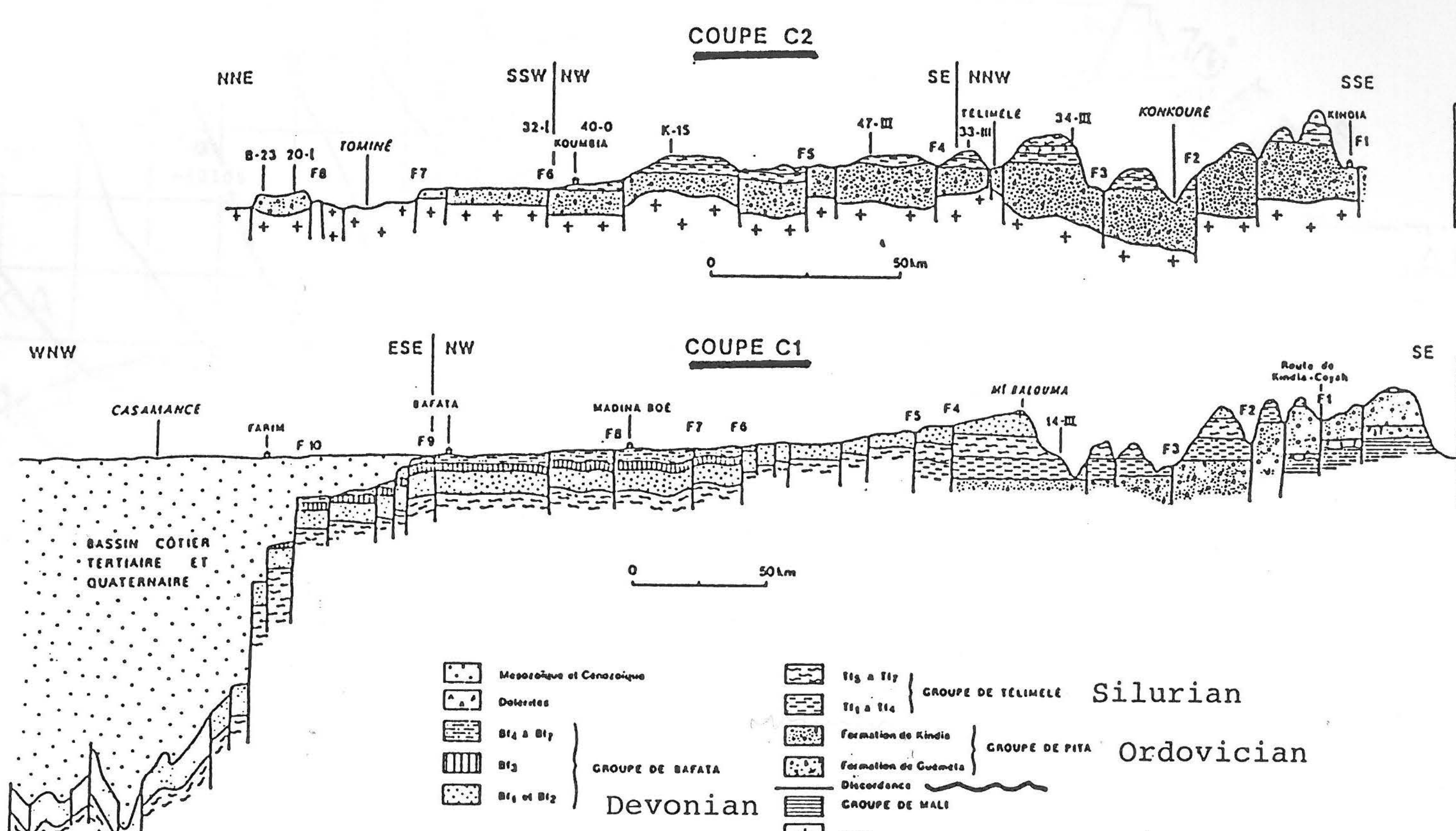
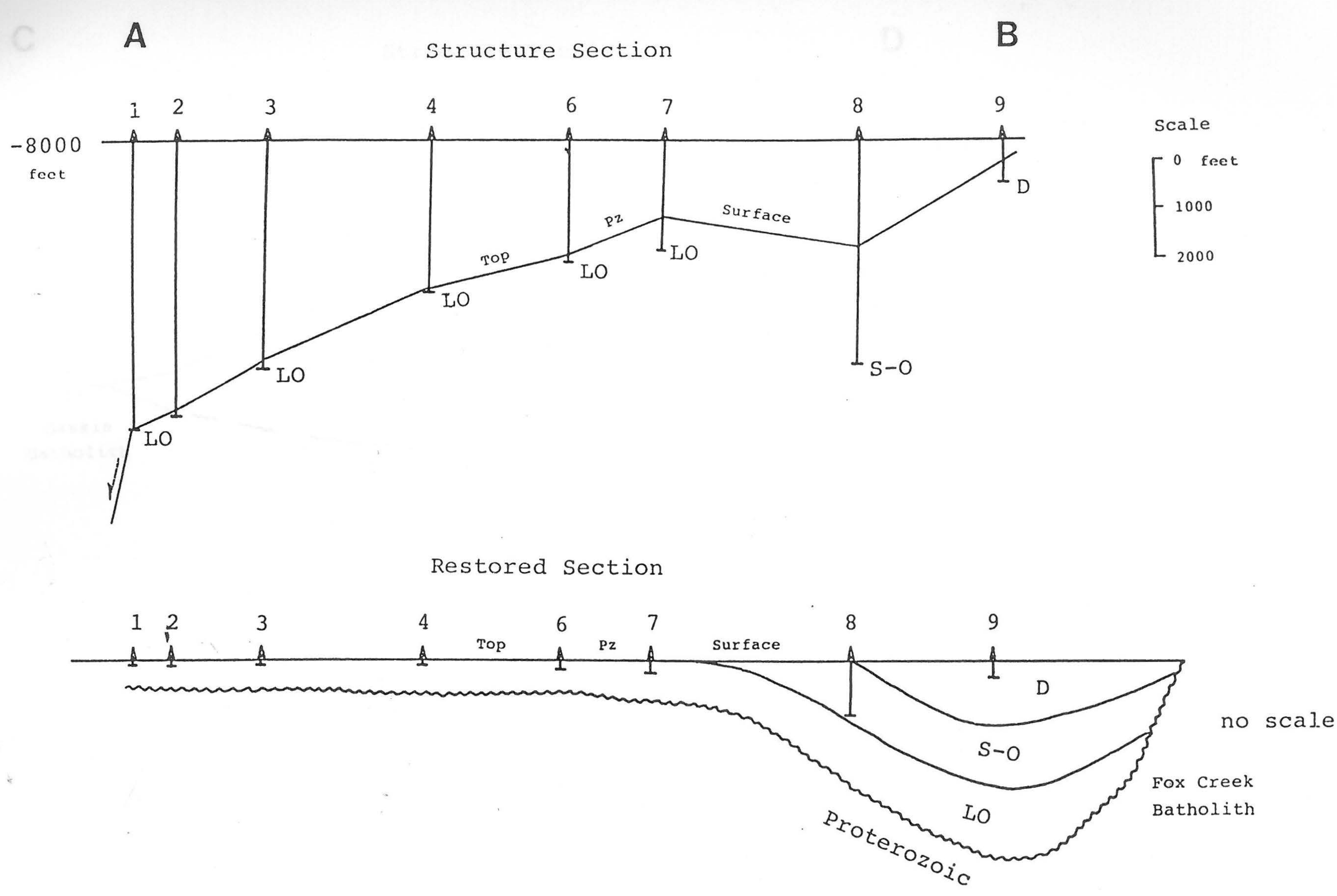


Fig. 179 : Coupes géologiques parallèles à l'axe du bassin Bové.

Fig. 5

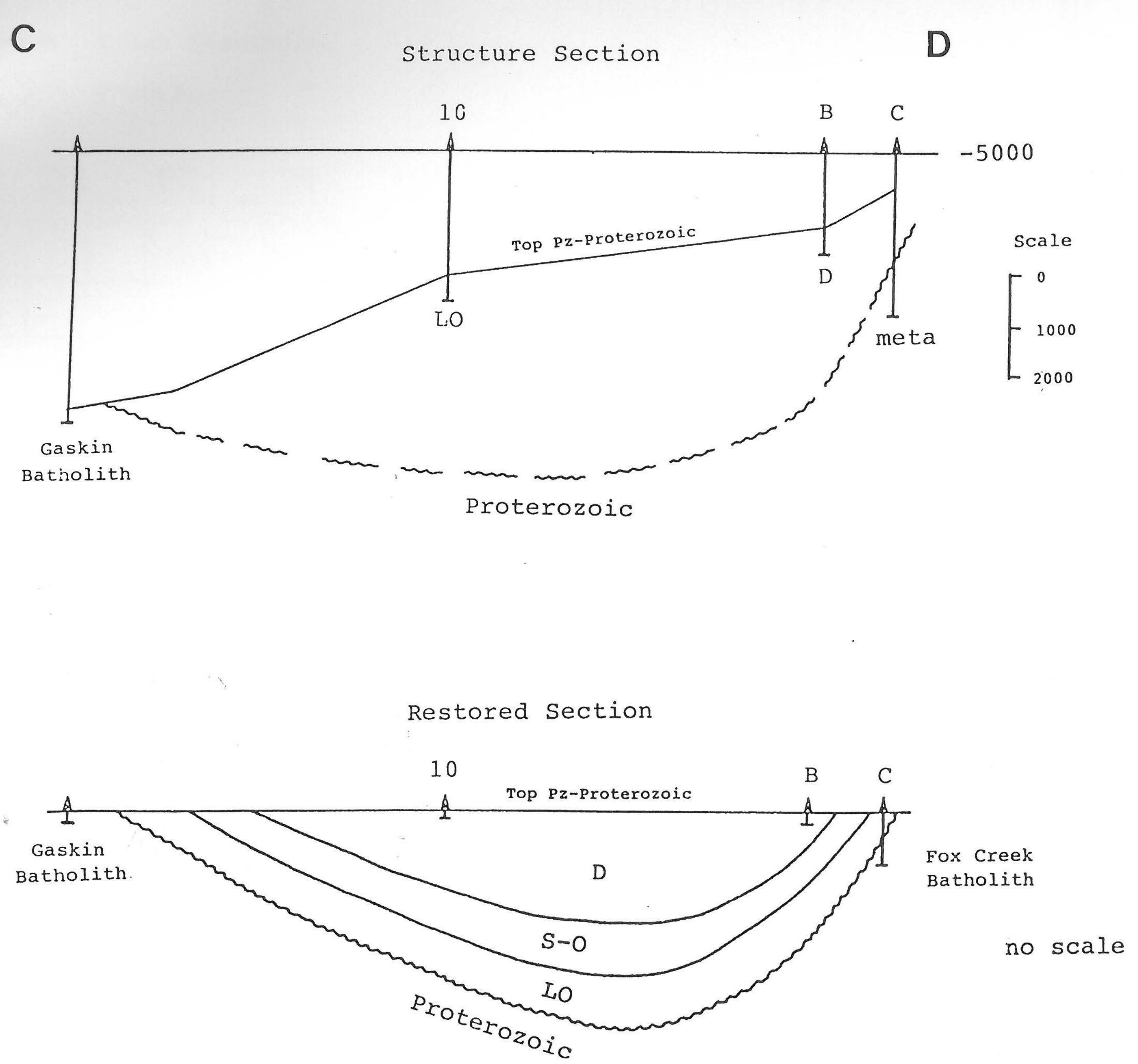
Paleozoic Structure

Fig. 6



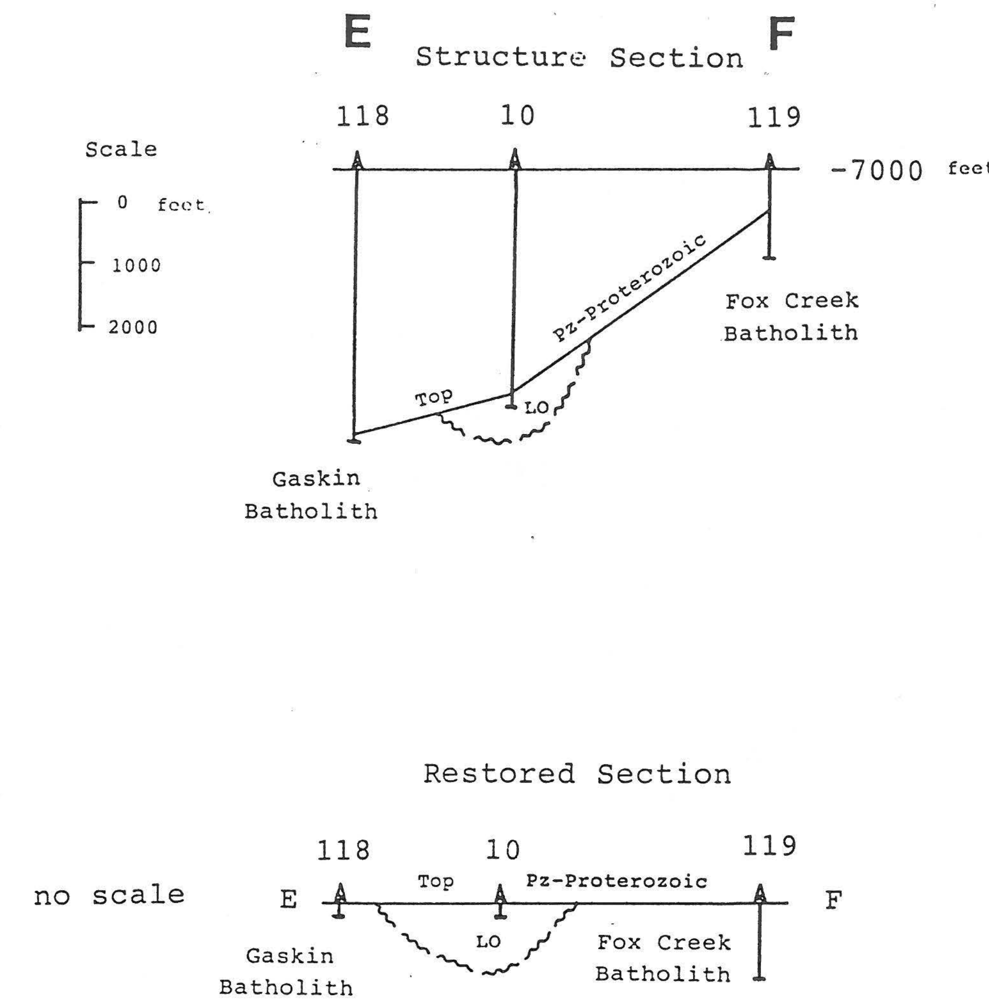
East-West Cross-section

Fig. 7

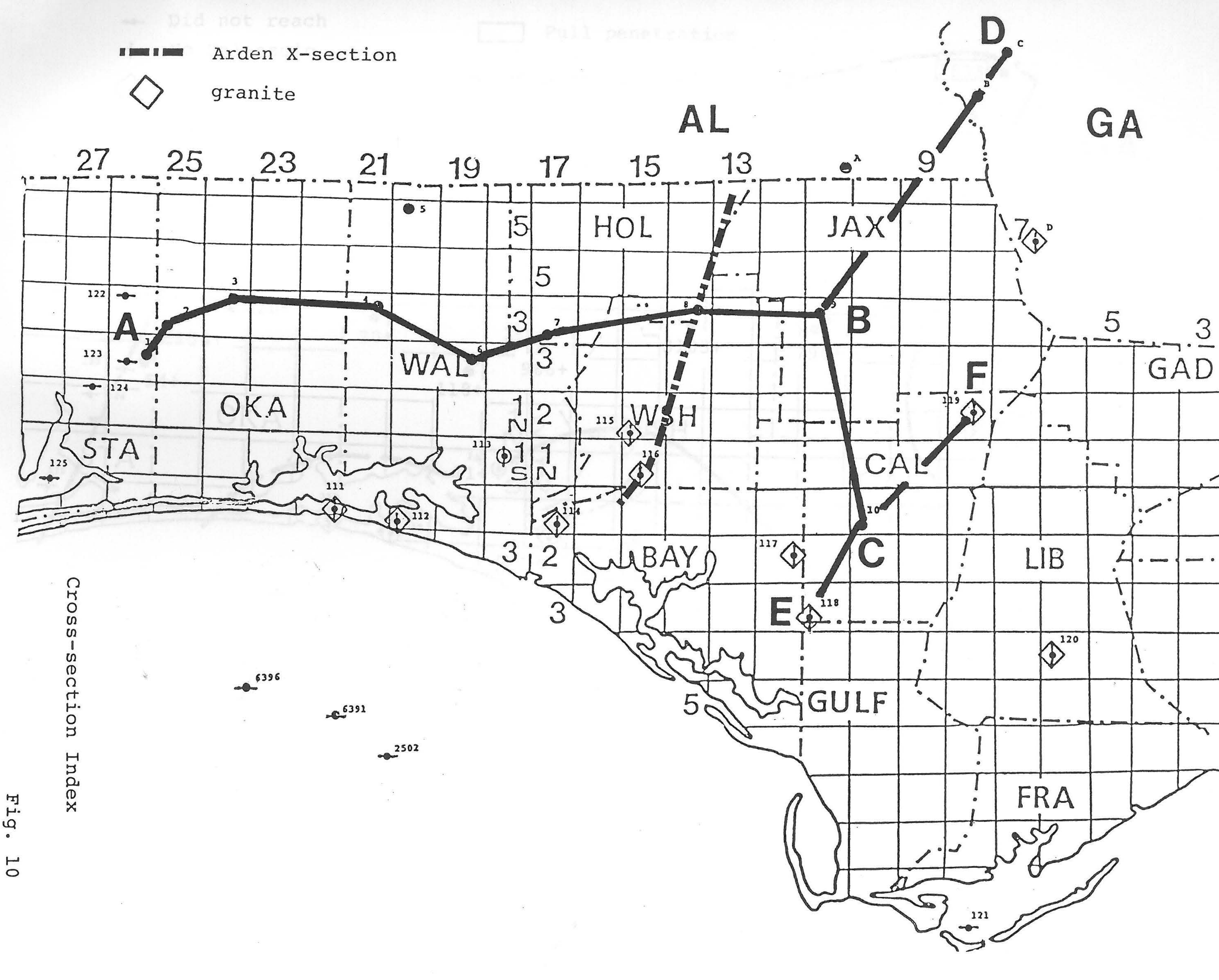


North-South Cross-section

Fig. 8

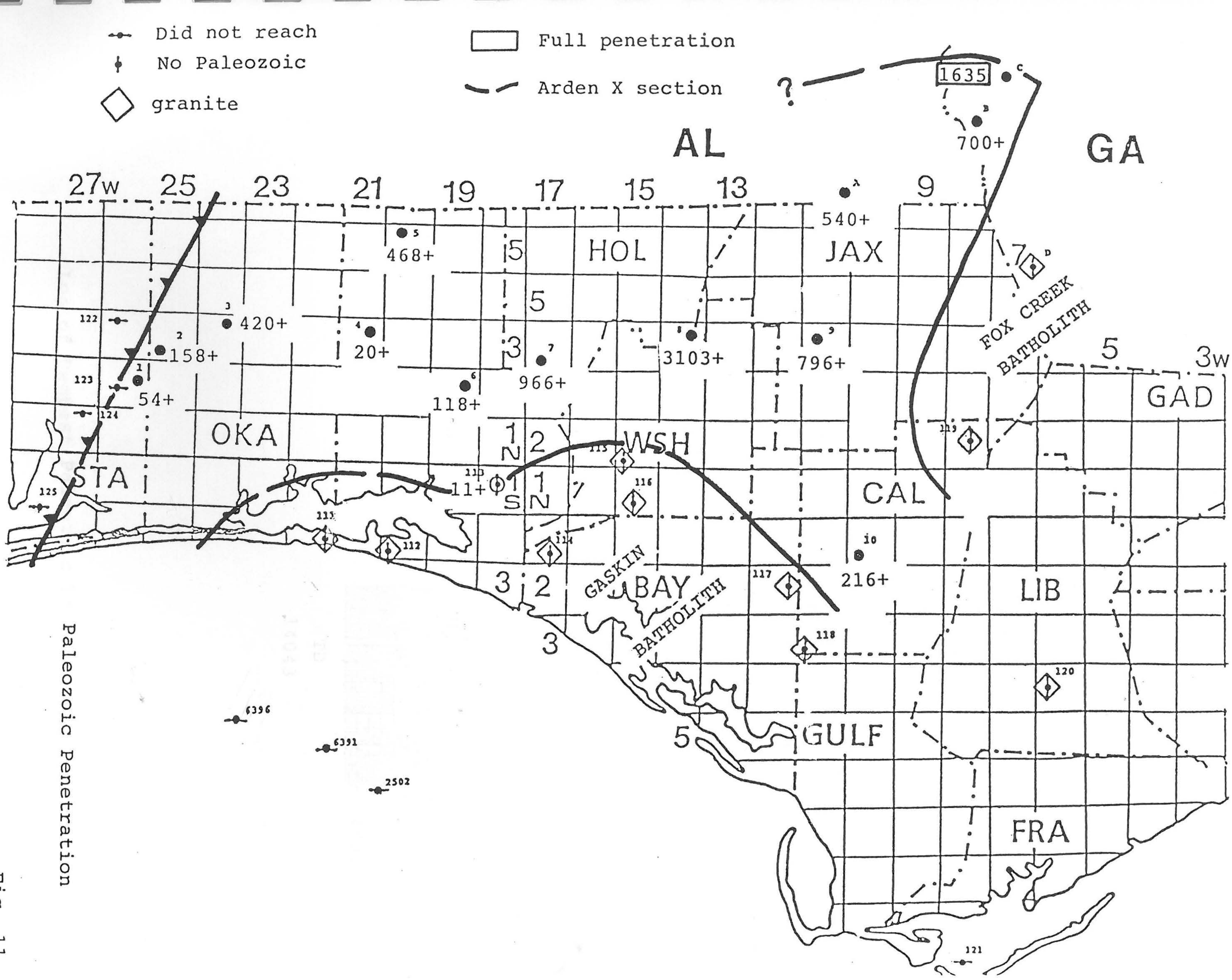


Cross-section E-F



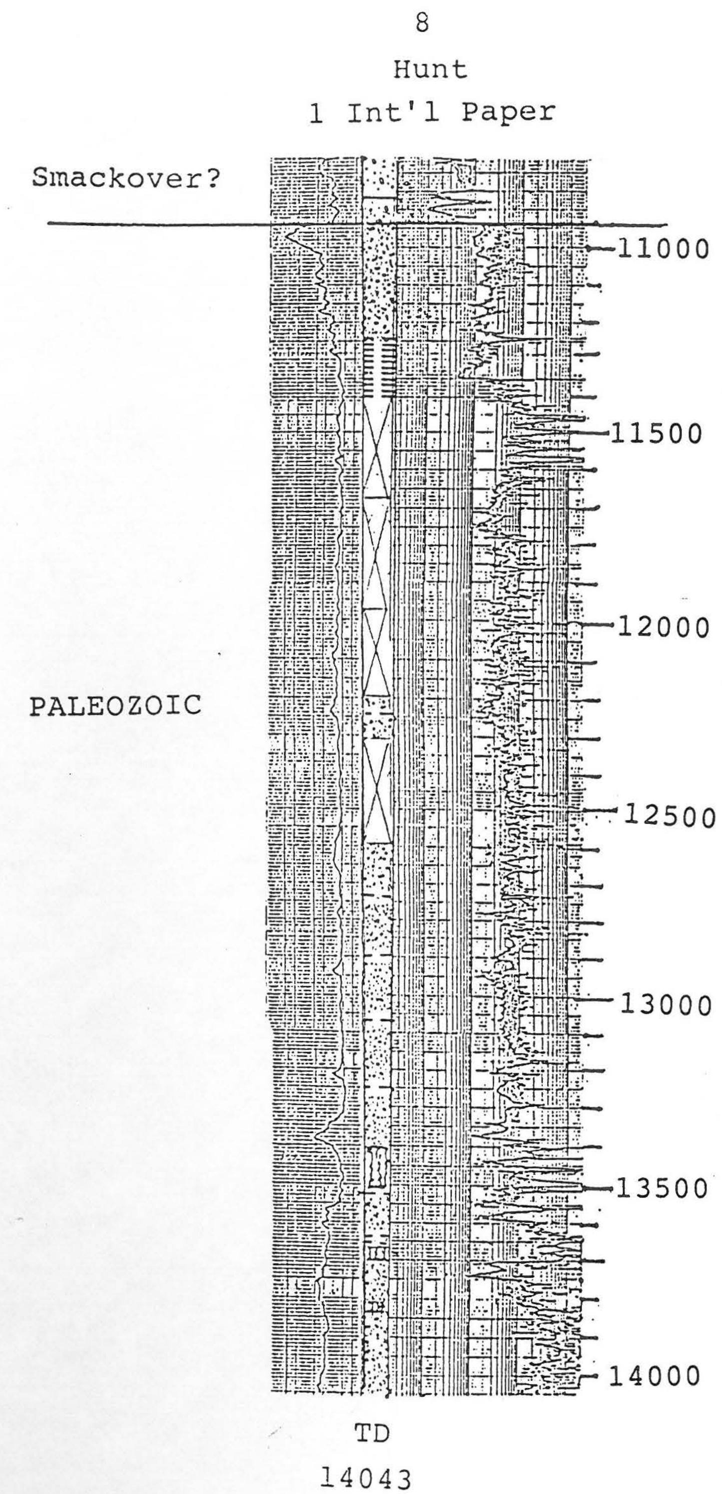
Cross-section Index

Fig. 10



Paleozoic Penetration

Fig. 11



sandstone

shale

diabase

Log of Deepest Paleozoic Penertation

Fig. 12