MAP SERIES NO. 116

FLORIDA GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES

EXPLANATION

- CLAY
- DOLOMITE
- LIMESTONE
- LIMITED POTENTIAL (TOPSOIL, FILL ETC.)
- SAND
- HARD ROCK PHOSPHATE (HISTORICAL MINING)
- CLAY, TESTED DEPOSIT
- MINE SITE (INACTIVE)
- MINE SITE (ACTIVE PIT, QUARRY OR MINE)
  - D DOLOMITE
  - L LIMESTONE

GILCHRIST COUNTY
DIXIE COUNTY
ALACHUA COUNTY
MARION COUNTY
CITRUS COUNTY
CHIEFLAND
BRONSON
WILLISTON
INGLIS
YANKEETOWN
CEDAR KEY
GULF OF MEXICO
SEABOARD SYSTEM RAILROAD
OTTER CREEK
GULF HAMMOCK
WEKIVA RIVER
WACCASASSA RIVER
COW CREEK
TENMILE CREEK
TURTLE CREEK
WITHLACOOCHEE RIVER

R 11 E | R 12 E | R 13 E | R 14 E | R 15 E | R 16 E | R 17 E | R 18 E
83°10' | 83°00' | 82°50' | 82°40' | 82°30'
T 10 S | T 11 S | T 12 S | T 13 S | T 14 S | T 15 S | T 16 S | T 17 S
29°30' | 29°20' | 29°10' | 29°00'

MINERAL RESOURCES OF

LEVY COUNTY

FLORIDA

(MODIFIED AFTER VERNON, 1951)

1988

SCALE

MAP SERIES NO. 116

MINERAL RESOURCES OF LEVY COUNTY , FLORIDA

BY

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FLORIDA GEOLOGICAL SURVEY

TALLAHASSEE, FLORIDA
1988

ISSN 0085-0624

LEVY COUNTY

INTRODUCTION

In recent years, considerable attention has been focused on Florida's rapid development, accompanying population increase and their effect on the state's important mineral resources. Frequently, urban development has occurred in areas underlain by known mineral deposits, which precludes future extraction of the minerals. The economics associated with these mineral resources represent substantial employment and income to the private sector as well as taxes to county and state governments. One response to this growing conflict between rapid growth and development of the state's mineral resources was in the form of legislation enacted by the Florida Legislature in 1985 requiring each county to establish a comprehensive land use plan. Additional guidelines and due dates were established by the 1986 Florida Legislature.

In response to this act and at the request of the Withlacoochee Planning Council, the Florida Geological Survey initiated a study of Levy County's mineral resources. The objective of this report is to summarize and interpret geologic data (i.e., core and well cutting descriptions, geophysical logs, and data derived from field reconnaissance) in a format appropriate for use by city and county planners.

A knowledge of Levy County's mineral resources is basic and integral to the process of initiating, developing and implementing an effective comprehensive land use plan. This information and data are essential to planners and officials in their analyses of urban and rural development in such areas as zoning, road construction and the establishment of waste disposal sites.

Factors used in evaluating the economic value of the county's known and potential mineral resources are varied, changing, and in many instances interrelated, thus complicating an accurate assessment. The evaluation process is inherently dependent on an extensive exploration program, a necessary precursor to mining in order to determine reserves, content and extent of specific mineral resources. In addition, such factors as operating expenses, beneficiation, reclamation and capital costs of mining must be included in the overall calculations.

Resource evaluation for this report is based on a number of sources including Florida Geological Survey reports and unpublished data, field reconnaissance, state and federal statistical data, company reports, questionnaires, and numerous discussions with mining company personnel and state and federal officials. Although detailed information on company statistics is confidential, information of a more general nature is readily available or can be reasonably extrapolated from existing data. The diversity of sources as well as their close association to the various aspects of resource evaluation lends substantial confidence to the general assessments and inferences of this report.

METRIC CONVERSION FACTORS

In order to prevent the awkward duplication of English and metric units in this report the following conversion factors are provided.

MULTIPLY	BY	TO OBTAIN
feet	0.3048	meters
miles	1.609	kilometers

GEOMORPHOLOGY

Vernon (1951) and White (1970) are primary sources for the following summary of the geomorphology of Levy County. Levy County falls within the central (Mid-peninsular) physiographic zone of White (1970). This area is typified by ridges, valleys and terraced coastal plains. Within this zone Levy County can be subdivided, based on topography, into two major geomorphic regions, the Central Highlands and the Gulf Coastal Lowlands (Figure 1).

The Central Highlands comprise the eastern third of the county. This region is further subdivided, based on topography, into the Western Valley and the Brooksville Ridge.

The Western Valley (White, 1970) is located in the eastern portion of the county. This geomorphic feature extends both east and south into Marion County and north into Alachua County and is bounded on the west by the Brooksville Ridge. In Levy County this region encompasses the Williston Limestone Plain (Vernon, 1951), a well-developed, gently rolling limestone plain with surface elevations ranging from 60 to 100 feet above mean sea level (MSL) (Figure 1). A veneer of sands and clayey sands cover the older underlying limestone surface of this plain. Vernon (1951) considered this to be a relict erosional limestone shelf of Eocene sediments that represent the seaward extension of the ancient Wicomico Sea. In addition, a number of inactive hardrock phosphate pits are present throughout the area.

The Brooksville Ridge, a part of the Central Highlands, is present in only a portion of eastern Levy County (Figure 1). This geomorphic region is an upland composed of sand and clay that overlies limestone. In appearance, the Brooksville Ridge, with some elevations greater than 150 feet MSL, stands out in sharp contrast to the topographically lower plains above which it rises. The Brooksville Ridge is bounded to the west by the Gulf Coastal Lowlands and to the east by the Western Valley. Vernon (1951) named this feature the Coharie-Okefenokee Sand Ridge.

The Gulf Coastal Lowlands occupies the largest part of Levy County (Figure 1). This region extends from the coastline to the Central Highlands near the eastern boundary of the county. The sediments in this geomorphic region consist primarily of a surface veneer of sand and clayey sand overlying limestone and or dolomite. Topographic mapping done for this report indicated elevation differences across the county as shown in Figure 2. While Figure 2 is not a terrace map, per se, it is meant as a reference for the following discussion of the possible ancient terraces and shorelines in Levy County.

In Levy County Healy (1975) differentiated five terraces, from highest (and presumably oldest) to lowest (youngest) : Sunderland-Okefenokee (100 to 170 feet MSL), Wicomico (70 to 100 feet MSL), Penholoway (42 to 70 feet MSL), Pamlico (8 to 25 feet MSL), and Silver Bluff (1 to 10 feet MSL). He did not distinguish an intermediate terrace, the Talbot (25 to 42 feet MSL), which is recognized in various other parts of Florida. In addition, he stated that the Penholoway terrace and shoreline are obscure in Levy County. Based on their encompassing elevations Healy (1975) combined parts of the Talbot and Penholoway Terraces to form a broader Wicomico Terrace. The three terraces most closely associated with the Gulf Coastal Lowlands, part of the Wicomico, the Pamlico and the Silver Bluff, exhibit a nearly northwest-southeast trend, approximately parallel to the present Levy County coastline (Figure 2). The Central Highlands includes parts of Healy's (1975) three higher terraces, the Sunderland-Okefenokee (100 to 170 feet MSL), the Wicomico (70 to 100 feet MSL), and the Penholoway (42 to 70 feet MSL), and Vernon's (1951) Coharie-Okefenokee Sand Ridge.

Vernon (1951) recognized only two terraces in Levy County, the Wicomico and Pamlico, the others having been so eroded that he could not separate them into distinct units. Associated with his Wicomico Terrace is a rolling terrain that Vernon (1951) called the Chiefland Limestone Plain (Figure 1).

The Pamlico Terrace lies between the Silver Bluff Terrace and the Wicomico Terrace and covers most of west-central Levy County. This area has a number of karst features including numerous sinkholes and caverns. In addition, a number of streams and creeks including Otter Creek, Cow Creek, Ten Mile Creek, Turtle Creek, and the Waccasassa and Wekiva Rivers flow through this general area.

The Silver Bluff Terrace extends from the present coastline inland a distance that varies from approximately two miles in southern Levy County to approximately 10 miles in northern Levy County near the coastal boundary between Levy and Dixie Counties. The development of sand beaches has been hindered along this coast due to low wave energy and inadequate sand supply (Tanner, 1960).

Associated with the Silver Bluff Terrace are extensive coastal swamps and marshes that extend up the Suwannee River valley. This area includes all continuous fresh water swamps and salt marshes adjacent to the Gulf of Mexico. Elevations in these low areas are generally less than 10 feet above mean sea level.

GEOLOGY

The following discussion of geology is summarized primarily from Vernon (1951) and Knapp (1978). Paleozoic Era shales and quartzite pebble sands occur at depths greater than 3,900 feet below land surface in three oil test wells (Florida Geological Survey well numbers W-1537, W-2012 and W-3342). These are in turn overlain by a thick section of younger Paleozoic, Mesozoic and Cenozoic carbonates (limestone and dolomite) that are overlain by a surface veneer of quartz sands, silts, clayey sands and clays. Figure 3a shows the location of cross sections used in this report. These cross sections show Middle Eocene to Recent age sediments (Figures 3b and 3c).

The Ocala Uplift, which crests in Citrus and Levy Counties, has significantly influenced much of the surface geology of Levy County. This feature measures more than 230-miles long and 70-miles wide in west-central Florida and has both altered the orientation of older deeply buried sediments and affected the deposition of younger sediments (Vernon, 1951).

The Avon Park Formation (Applin and Applin, 1944; Miller, 1986), which is present as surface outcrops in Levy County, includes the oldest rocks exposed in Florida. This formation underlies all of peninsular Florida and was deposited in a shallow marine environment approximately 45 million years ago. These carbonate sediments, which in Levy County consist of fossiliferous dolomite, can be observed in various quarries in central and southeastern Levy County and along the Withlacoochee River Valley. The fossils include among others: plants, echinoid molds and casts and forminifera.

The younger Ocala Group limestones, which were deposited in a shallow marine environment approximately 38 to 40 million years ago, overlie the Avon Park Formation. The Ocala Group consists of three formations, from oldest to youngest: the Inglis, Williston and Crystal River Formations. In this report these formations are combined and referred to as the "Ocala Group Undifferentiated" (Figures 3b and 3c). These sediments are primarily limestones and vary in composition from limestone ($CaCO_3$) to dolomite ($Ca.MgCO_3$). They occur as sporadic outcrops in northern and eastern Levy County. Influenced by the Ocala Uplift, thicknesses of these sediments have been erosionally thinned and are extremely variable. The Ocala Group limestone forms a land surface upon which a karst topography has evolved. As a result, numerous caverns, sinks and depressions are common in the vicinity.

The Suwannee Limestone, which is present in neighboring Citrus County, is absent in Levy County. In contrast to a maximum observed thickness of 83 feet of Suwannee Limestone in Citrus County (Florida Geological Survey well number W-274), extensive erosion or non-deposition has removed these sediments in Levy County (Figures 3b and 3c).

Miocene to Holocene age siliciclastic sediments (sands, clayey sands, silts and clays) unconformably overlie the Ocala Group. These sediments, which form a surface veneer of varying thickness, are shown on Figures 3b and 3c as "Undifferentiated Sands and Clays". The Miocene Epoch Hawthorn Group sediments, consisting of massive to blocky, greenish-gray clays and interbedded deposits of phosphatic clay, sand and sandy clay, are present primarily in the northeastern corner of Levy County (Vernon, 1951).

Deposits of Pleistocene and Holocene sediments cap the Brooksville Ridge and occur as irregular elongate bands of sands and clayey sands that parallel the present coastline (Vernon, 1951). In addition, Holocene alluvial sediments are associated with the rivers and streams throughout the county.

MINERAL RESOURCES

INTRODUCTION

The purpose of the following discussion is to provide information on the occurrence of certain mineral commodities in Levy County, and to show the results of selected tests and analyses performed on samples collected there. The information presented is not intended to be an exhaustive investigation leading to immediate industrial development, because in many cases the data represent information on a single outcrop, pit or mine. However, the data, where favorable, may indicate that certain areas might warrant further investigation. The Mineral Resources Map is designed to present a geographic overview of the major mineral commodities identified in Levy County. Factors such as thickness of overburden, quality and volume of the deposit could affect the mining of the mineral commodity at any specific site. In contrast, geologic cross sections are extrapolated from cores and/or well cuttings to show the distribution and thickness of surface and near-surface stratigraphic units (Figures 3b and 3c). As a result, occasional variations between the geologic cross sections and the Mineral Resources Map may occur. The principal mineral commodities occurring in Levy County are clay, limestone, dolomite, phosphate and sand.

Clay

In Levy County, clay deposits are associated with Wicomico and Pamlico Terrace deposits (Vernon, 1951). These clay deposits, which occur over irregular limestone surfaces, are variable both in thickness and geographic extent.

Two clay samples were collected by Vernon (1951) at the following locations:

Sample 1: "Pit on the property of G. M. Cannon located on the center of section line, section 33 and 34, T16S, R17E, where 6 feet of gray to brown, argillaceous sand ... is exposed.

Sample 2: "Pit in the center of the SW 1/4 Sec. 32, T12S, R17E, exposing 4.1 feet of blue clay ...

Vernon (1951) reports that the samples taken were easily abraded after firing, and had poor strength which makes them of little value for use as structural clay products. However, by mixing the two samples described above and adding feldspar or other fluxes the clays may be used in a pottery body that will fire buff-colored. The determination of the suitability of the two areas mentioned above for industrial development will require extensive drilling and laboratory analyses.

Limestone

Limestone of economic importance in Levy County occurs in formations deposited during the Eocene Epoch. The Inglis, Williston and Crystal River Formations of the Ocala Group are high calcium limestones approaching the purity of 100 percent calcium carbonate (Vernon, 1951). At some localities the Inglis Formation is dolomitized and as a result of this recrystallization it is generally harder than the overlying Crystal River and Williston Formations. However, locally where the Crystal River Formation has been recrystallized, there are hard zones. As shown on the Mineral Resources Map, the limestones that have potential for economic development occur extensively throughout much of Levy County.

Limestone has been mined in Levy County for a number of years. Presently, there are five active limestone mines in the county (Mineral Resources Map).

The open pit mining method is used by the companies mining limestone in the county. Before mining begins in an area, a bulldozer clears away vegetation and removes the overburden. The thickness of the overburden in Levy County is variable, which reflects the irregular surface of the underlying limestone. The overburden in places has thicknesses approaching 30 feet and may have potential as a local source of fill (Figure 3b). After an area is cleared, shot holes are drilled into the rock and the quarry face is fractured. The fractured rock is then transported to rock crushers for processing.

Generally, the limestone from the Crystal River, Williston, and Inglis Formations is soft and pure enough for use as coarse base material for roads, agricultural purposes, fines for filler in bituminous mixes for road surfaces, and in the manufacture of lime. In 1981, the total production of crushed stone in Levy County was 4,127,000 short tons (Boyle and Hendry, 1985). However, some of this production can be attributed to dolomite. Although the exact reserves of limestone in Levy County are not known, the county has abundant reserves of high grade limestone occurring beneath a thin overburden.

Dolomite

Dolomite as a rock term is defined by Schmidt, et al., (1979) "as a sedimentary rock containing more than 50 percent of the mineral calcite and dolomite, with dolomite being the most abundant." The dolomite mined in Levy County from the Avon Park Formation is a tan to brown, unconsolidated to well indurated rock and analyzes 36 percent magnesium carbonate (Vernon, 1951). As shown on the Mineral Resources Map, dolomite deposits are located in the south-central part of the county. Dolomite is mined in Levy County by the open pit method. The area to be mined is cleared of vegetation and any shallow sandy overburden is removed by a bulldozer. The dolomite is fractured by blasting to facilitate mining and then removed by a dragline. The dolomite that extends below the water level requires mining underwater by dragline, or extensive dewatering of the pit if other equipment is used. The depth to which the rock is mined below water level is controlled by the limitations of the equipment and the characteristics of the deposit. At the present time, the only dolomite mined in Levy County is near Gulf Hammock (Mineral Resources Map).

The dolomite rock mined in the area is used as a soil conditioner, as an aggregate in concrete, and as a filler in bituminous mixes. No figures are available for dolomite production or reserves in Levy County.

Hardrock Phosphate

Phosphate deposits occur in Levy County in a portion of a larger geographic area called the Hardrock Phosphate District (Espenshade and Spencer, 1963). The Hardrock Phosphate District is a linear belt which extends from the eastern side of Levy County northward through Marion, Gilchrist and Suwannee Counties and southward into Citrus County. The hardrock deposits consist of boulders, pebbles, and small grains of phosphate, clay, sand, chert, and silicified limestone lying upon a limestone surface. The surface is irregular due to solution and replacement of limestone (Vernon, 1951). According to Espenshade and Spencer (1963), hardrock phosphate deposits seem to have been formed by "very thorough ground-water leaching of phosphate from marine phosphorite beds and redeposition of phosphate at a depth as secondary apatite by replacement of limestone and precipitation in cavities, as proposed by some earlier investigators."

When hardrock phosphate was first mined, horse-drawn scrapers were used to remove the overburden so that the ore could be removed by pick and shovel. Later, draglines were used to remove the overburden and the ore (Espenshade and Spencer, 1963). Hardrock phosphate mines are located on the eastern side of the county; however, there are presently no hardrock phosphate producers in the county.

Softrock (Colloidal) Phosphate

Waste material produced during the process of washing hardrock phosphate consisted of quartz sand and a tan to gray, soft, phosphatic clay (Vernon, 1943 and Calver, 1957). The separated waste clay and sand were discharged to settling areas from which the clay became available for later recovery.

The locations of the softrock phosphate deposits are confined to those areas in close proximity to the pits where hardrock phosphate was mined. At the present time there is no production of softrock phosphate in Levy County.

Sand

Quartz sand covers the limestones and dolomite on the west side of Levy County in the Gulf Coastal Lowlands area. Thicker deposits occur in dune areas along the coast and in an elongated area on the eastern side of the county. The thicker sands are associated with the Brooksville Ridge and the coastlines of the Pamlico and Wicomico Terraces (Vernon, 1951).

Kolb (1974) presents data on soil ratings, limitations, and features affecting selected uses by soil associations. This information is useful in determining an area's general suitability for various land uses. The soil survey of Levy County indicates that the soils St. Lucie, Kureb, Rimini, Chandler, Apopka, and Jonesville are rated as good sources of sand and roadfill (Kolb, 1974). The good rating for these soils indicates that the sand occurs within six feet of the land surface and is at least three-feet thick. Mining factors such as overburden thickness, depth to the watertable and quality of the material are not considered in the sand rating. Roadfill ratings depend on the ease of removal of material at a borrow site and how the soil will perform in an embankment that has been properly compacted and provided with adequate drainage (Kolb, 1974). The St. Lucie, Kureb and Rimini soils are located in the Gulf Coastal Lowlands. The Chandler and Apopka soils are predominantly found along the Brooksville Ridge with a minor portion occurring in the southern part of the Western Valley. Although the Jonesville soil occurs in the Western Valley along the Levy-Alachua County line, it is largely found in the Gulf Coastal Lowlands. At present, sand in Levy County is used primarily for local fill.

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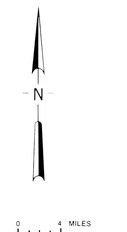


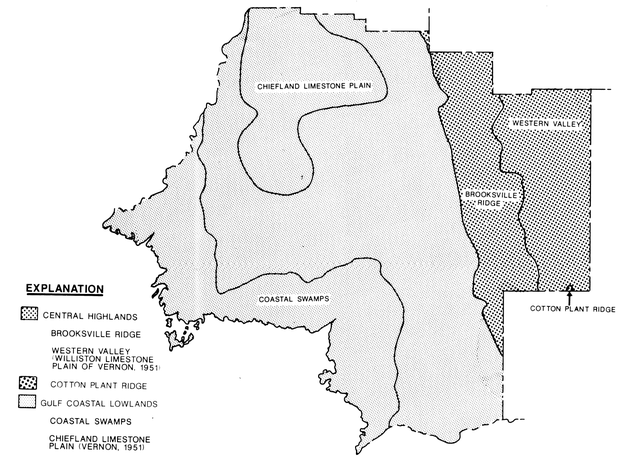


FIGURE 1 GEOMORPHOLOGY

(modified from White, 1970 and Vernon, 1951)

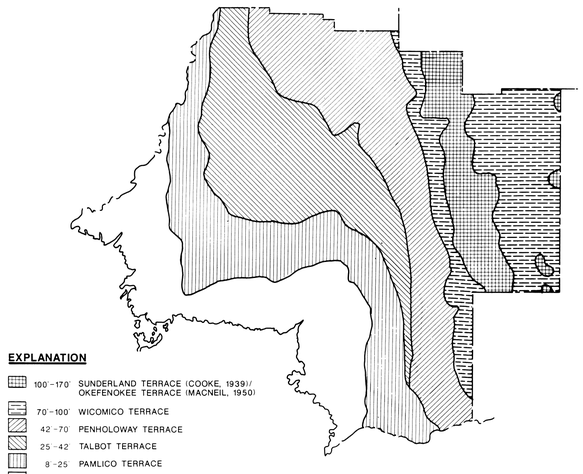


FIGURE 2 TERRACES AND SHORELINES

(modified from Vernon, 1951 and Healy, 1975)

The well and quarry system used in this report uses the rectangular system of section, township and range for identification. The well or outcrop number consists of six parts: W for well or L for quarry, county abreviation, the Township, Range, and Section, and the quarter/quarter location within the section.

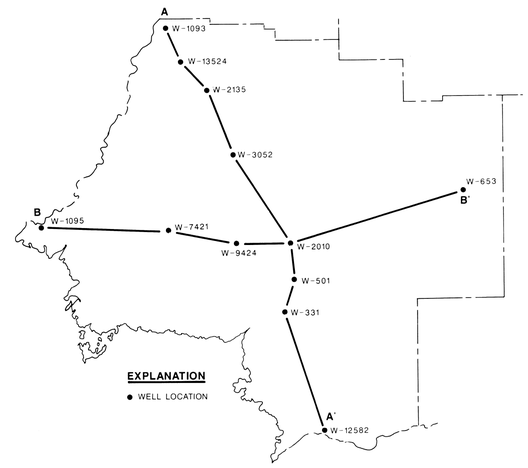
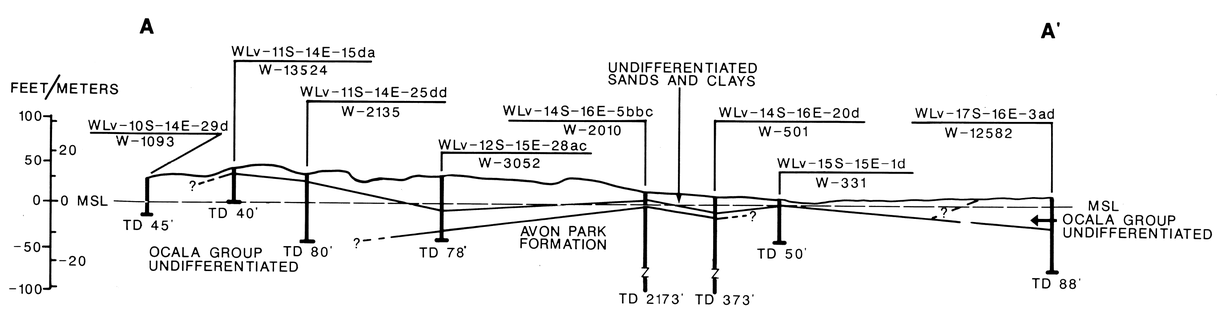


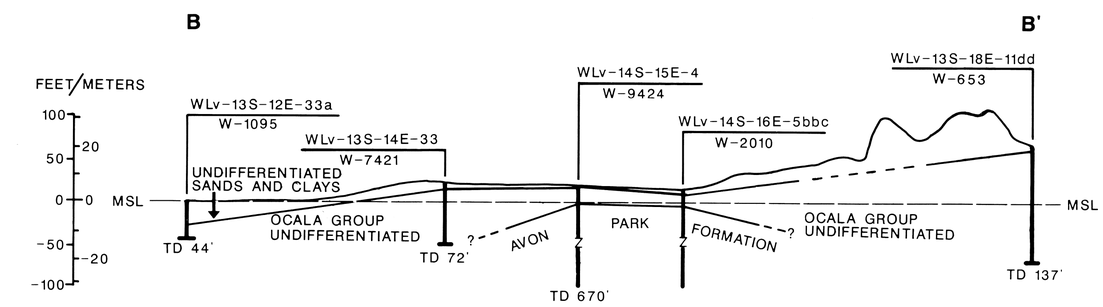
FIGURE 3a CROSS SECTION LOCATIONS



VERTICAL EXAGGERATION IS APPROXIMATELY 211 TIMES.

FIGURE 3b CROSS SECTION A-A'

0 4 MILES
0 6 KILOMETERS
SCALE



VERTICAL EXAGGERATION IS APPROXIMATELY 211 TIMES.

FIGURE 3c CROSS SECTION B-B'