STATE OF FLORIDA

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NATIONAL GEOLOGICAL AND GEOPHYSICAL DATA PRESERVATION PROGRAM
G14AS00026
Florida Geophysical Log Preservation
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2014 – 2015 FINAL SUMMARY REPORT

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INTRODUCTION

Under federal grant G14AS00026, the Florida Department of Environmental Protection/Florida Geological Survey (FDEP/FGS) continued the work started in 2011 of scanning and developing metadata for geophysical logs in its sample collection for the USGS – National Geological and Geophysical Data Preservation Program (NGGDPP). Previously, the FDEP/FGS had scanned and prepared metadata for approximately 5,300 geophysical log documents stored at the FDEP/FGS as part of previous NGGDPP grant program awards. This collection was originally described and submitted as NGGDPP Collection ID: 1087785 - Well logs from Florida.

These scanned logs have been stored locally on a network server while important information from the log headers was entered into the FDEP/FGS borehole database where it is linked to other borehole information. The primary project goals included converting the estimated 2,500 paper geophysical log documents remaining to image files and digitizing select logs into universal LAS files. These goals would preserve and prevent loss of irreplaceable information and provide more efficient, cost effective access by professional and public entities.

Additional goals included: verifying locations for the boreholes corresponding to the logs; creating up-to-date metadata records; and improving ease of use for FDEP/FGS customers to access the logs by linking the geophysical logs to entries already existing as part of the state's sample collection.

BACKGROUND

Definitions and Designations

A geophysical log document was defined as a single unit with a unique file name. A majority of FGS geophysical log documents were physical documents on various types of paper. These documents were scanned at 300 dpi as TIFF files. Additional documents included PDF files from the Northwest Florida Water Management District (NWFWMD), which previously were given a geophysical log designation but were missing physical copies from our collection.

A geophysical log set was defined as a collection of physical paper documents for the same borehole, run by the same agency. FGS previously gave designations for each of these sets. Runs on multiple dates often were grouped as a single set; however, in some cases where header information was vague, these runs were separated into multiple sets. One of the goals of the project was to reconcile these sets to refer to the same borehole records in the FGS database, eliminating unnecessary records.

The FGS currently has two primary designations for boreholes within the database. The first is known as a *W number* and refers to a borehole that we have (or had, at some time in the past) samples stored in our repository. The second designation is a *wgi number*, which refers to a borehole that we have received geologic information about, but no samples. In the case that FGS receives samples for one of these boreholes, it then would receive a W number, which then would remain its primary designation. If a geophysical log set could not be correlated to a borehole with a known FGS designation, it was considered "orphaned," and in the near future will receive a wgi number designation.

Only about a quarter of the geophysical log sets can be correlated to a borehole with a W number, and half as many to a borehole with a wgi number. This leaves a majority of sets without a designation. One goal of the project was to correlate as many boreholes as possible and eliminate these "orphans." In addition, boreholes were correlated to USGS Site ID's as well as water management district ID's, where applicable.

Geophysical Log Details

The geophysical log collection consists of the various logs run on exploratory boreholes as well as water, injection, oil and gas, observation, and monitor wells throughout the state of Florida. The collection represents approximately 5320 boreholes, some of which are also represented in the core and well cuttings sample collection. The physical geophysical log collection is currently stored in four file cabinets, organized by county.

These paper logs are long, continuous, accordion sheets. Some of the logs are printed on delicate onion skin paper; many others are on thermal paper. Old thermal paper tends to turn black or lose contrast, and many of the documents in the collection are fading or faded. The logs include the following types: Spontaneous Potential (SP), Single Point Resistance (SPR), Time, Caliper, Fluid Conductivity, Magnetic, Electrical Induction, Natural Gamma, Dipmeter, Laterolog, Micro Laterolog, Neutron, Photo, Radioactivity, Sonic, Temperature, Gamma-Gamma, Resistivity, and Fluid Velocity.

The collection contains logs run by multiple agencies including: the FDEP/FGS (previously the Bureau of Geology), the U.S. Geological Survey, and four of the five water management districts of Florida. The remaining 10% were run by various private drilling and geophysical logging companies.

The most common log types in the collection are gamma, resistivity, spontaneous potential, and caliper. Table 1 shows the breakdown of log types within the FDEP/FGS Collection.

Table 1. Count of the most common log types

Log Type	Count
Gamma	4636
Resistivity (Normal, Single Point, & Lateral)	4442
Spontaneous Potential	2957
Caliper	2909
Temperature	1325
Fluid Conductivity	688
Fluid Velocity	463
Neutron or Gamma-Gamma	369
Other Logs	702
Total	**18491**

Resistivity, Gamma, and Neutron logs are the most valuable log types, especially in geological units of early Eocene age or older. There is currently an increased interest in these lower geologic units for natural gas exploration, carbon capture and storage, wastewater injection and lower Floridan aquifer system studies. With this increased interest, the FDEP/FGS anticipates an increase in requests from both the public and private sectors for lithologic descriptions and geophysical logs of deep boreholes. At the start of the project, it was estimated that there are approximately 120 of these logs within the collection with depths reaching lithology of early Eocene age and older, with over 200,000' of total footage.

For the aforementioned reasons, the FDEP/FGS began to digitize select logs into LAS files to improve utility and access to this valuable geologic information. Eighty (80) individual log curves for 35 boreholes were digitized, representing approximately 158,000 feet. Figure 1 shows an example of a scanned log and its final LAS file as displayed in Neuralog.

SUMMARY OF ACTIVITIES

First Quarter (September – November 2014)

A Neurascanner was provided by the Oil & Gas section of FDEP via temporary loan to complete scans that were not completed previously. Scanning began in September of 2014 while header entry and location verification were started as part of concurrent projects at the FGS. Digitizing of select scans were started as well.

Second Quarter (December 2014 – February 2015)

A general slowdown occurred through the holidays and continued through February as the Principal Investigator (PI) was on medical leave and the FDEP/FGS prepared and completed a move to a new facility. Data entry continued when possible; however, scanning stopped when the scanner broke down in late January and was shipped out for repair.

Third Quarter (March – May 2015)

Productivity increased as new hires began. Header entry as well as scanning Q/A were the primary focus. Location verification and well correlation also began. The scanner was repaired and back in FGS custody in early April, allowing scanning to resume. Additional digitizing efforts were continued.

Fourth Quarter (June – August 2015)

Scans were completed and rescans were started as scanning Q/A progressed. Many scans previously completed from prior years were not scanned adequately, due to faulty scanning equipment and poor oversight. Location verification and well correlation became a major focus.

Final Metadata Cleanup

Metadata continued to be cleaned up by staff after the project was officially over, up to the submission of this final report. The tasks of verifying and correlating the boreholes related to the geophysical logs will continue over the next few years as new information surfaces and additional FGS inventory is verified.

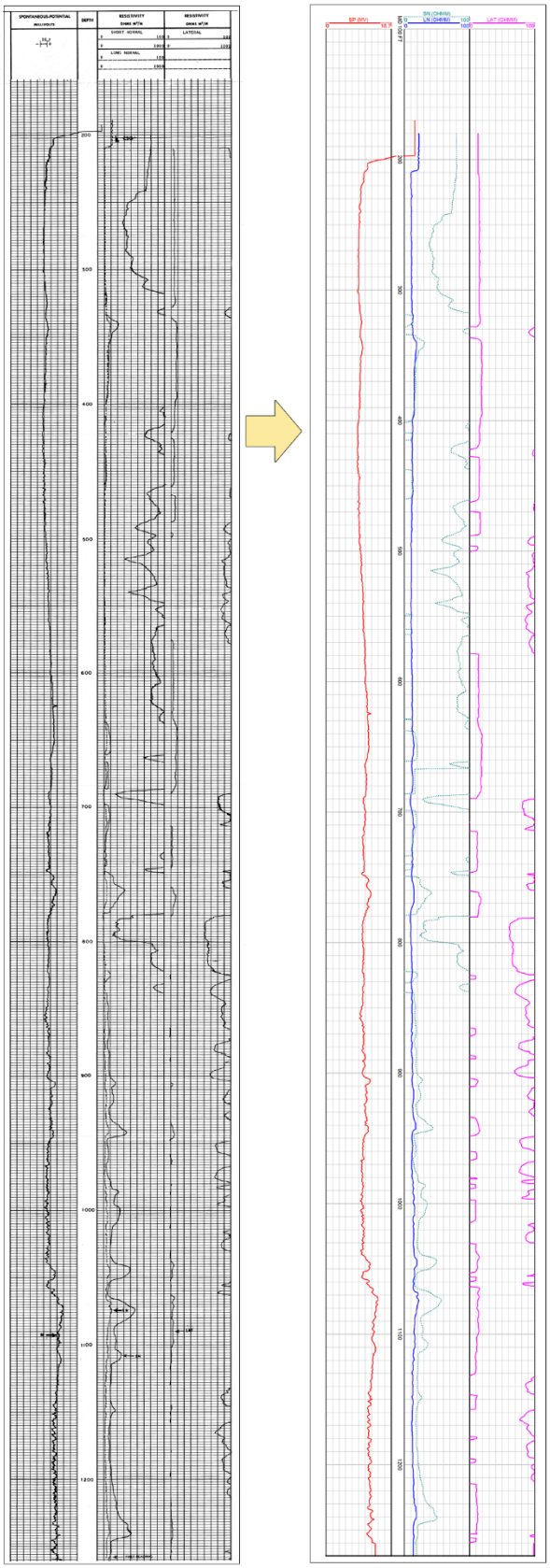

Figure 1. Example of Converting a Geophysical Log Scan to an LAS File

PROJECT IN REVIEW

During the last project in federal year 2011, the working database was not yet part of the FDEP/FGS geologic database. From the time that the previous project ended and the 2014 project began, all geophysical log information was imported. Quality assurance activities were needed throughout the 2014 fiscal year to verify the information was entered and imported correctly. The result of these activities was an increase of both total sets and missing sets.

Database Records as of 09/01/14:
Total Sets: 5263
Missing Sets: 73
Orphaned Sets: 3423
Total Documents: 8012
Scanned Documents: 5239

Database Records as of 10/29/15:
Total Sets: 5459
Missing Sets: 304
Orphaned Sets: 3406
Total Documents: 9466
Scanned Documents: 9304

The geophysical logs represent 5320 boreholes, 1240 for which we have or have had samples in our repository. Missing sets include 215 sets that where logged by Northwest Florida Water Management District (NWFWMD). Out of these sets, 95 were received as pdf files from NWFWMD. In addition, ten log sets were moved to different counties after location verification, leaving empty records (marked as missing sets) in some cases.

Several documents that were previously scanned had to be rescanned due to poor quality. Out of the total 9468 documents, 4698 were scanned previously and retained. Approximately 1000 documents were rescanned. Several will need additional imagery adjustments; however, those with poor or fair document condition will be limited on the image quality that can be achieved.

Since the completion of the previous project in 2012-2013, our database was improved, making log scan information more intuitive to enter and QA/QC activities more streamlined. In addition, storage space was allotted for public access. Until files are fully uploaded to our publicly available storage space, the files will be available upon request. The conversion to LAS files will make the current storage capacity more efficient in serving this geophysical data out to our customers.

Future Goals

As previously mentioned, the tasks of verifying and correlating the boreholes related to the geophysical logs will continue over the next few years. Future goals of FDEP/FGS for our geophysical log collection include the following:

- Complete borehole correlation and location verification;
- Give boreholes with orphan logs proper designations;
- Compare our collection with those already scanned or digitized by other agencies to avoid duplication of work;
- Continue to digitize scanned logs within our collection;
- Redesign the FDEP/FGS website to include access to the geophysical log files; and
- Establish a process for adding logs to the collection.

METADATA EXPLANATION

Originally named, "Well Logs from Florida", the collection will be renamed to "Geophysical Logs of Florida" to more accurately describe the collection. Currently, no individual metadata records are available in the ScienceBase Catalog for this collection. Approximately 9300 metadata records will, therefore, be uploaded to the NGGDPP collection from this project and the previous project in federal year 2011. This will include 55 records for digital LAS files. The following are explanations for each field of the metadata to be uploaded.

CollectionID: "1087785"

Title: The title will include the Geophysical Log Number Designation from FDEP/FGS Collection (GPLN) followed by the geophysical log type codes included on the document. Table 2 lists the geophysical log types and their codes.

Table 2. Geophysical log types and their codes

A - Time	M - Micro Laterolog
B - Video	N - Neutron
C - Caliper	O - Spontaneous Potential
D - Density	P - Photo
E - Electric	Q - Radioactivity
F - Fluid Conductivity	R - Resistivity
G - Geologist	S - Sonic
H - Magnetic	T - Temperature
I - Induction	U - Gamma-Gamma
J - Gamma	V - Fluid Velocity
K - Dipmeter	X - Directional
L - Laterolog	Z - Other

If there are multiple wells with the same types, a sequential number will be designated for all those besides the first (see example below). The digital file format will also be listed. The following is an example of a title field entry:

FGS Geophysical Log AA-055 (C, J, T) #2 [TIF]

AlternateTitle: This field will not be used at this time, however, it may be used in future metadata updates.

Abstract: The abstract will include the following elements:

- GPLN
- Geophysical Log Description
- Agency that ran the log (for scan files)
- Well Designation (if available)
- Well Name
- County

- USGS ID (if available)
- Water Management ID (if available)
- API Number (if available)

All scanned documents will include:

- Document Information (Number of Log Curves, Media Type, and Document Condition)
- Scan Information (Date Scanned and Scan Quality)

All digitized LAS files will include:

- Digitizing Information (Number of Log Curves and Date Digitized)

The following is an example of one of the abstract records for a scanned document:

> *BY-022 - Electric Log (BOG): W-589 (Tyndall Field - Test Well #3), Bay Co., USGS ID: FL300358085353901, WMD ID: NWFID-296 & 297, [2 Curves on Standard Paper (Good Condition), Scanned: 10/11/2013 (Excellent)]*

DataType: "Geophysical Log"

SupplementalInformation: URL to the file

Coordinates: Geographic coordinates in the required format as: *Longitude,Latitude*

AlternateGeometry: Florida TRS location where the following codes represent the quarter sections: a = Northwest; b = Northeast; c = Southwest; and d = Southeast.

OnlineResource: URL to borehole information (for logs with a W number designation)

BrowseGraphic: URL to the Geologic Well & Borehole Data focus on MapDirect: *http://ca.dep.state.fl.us/mapdirect/?focus=fgsgeologicwell*

Date: The log document date (if available). If multiple run were done on one document, the most recent date will be used.

DatasetReferenceDate: Date of metadata modification

VerticalExtent: Top and bottom depth range of the geophysical log document in feet as: *ft,bottom,top*.