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Cruise Report - Rend Lake, Illinois

by Kathy Kent

PURPOSE

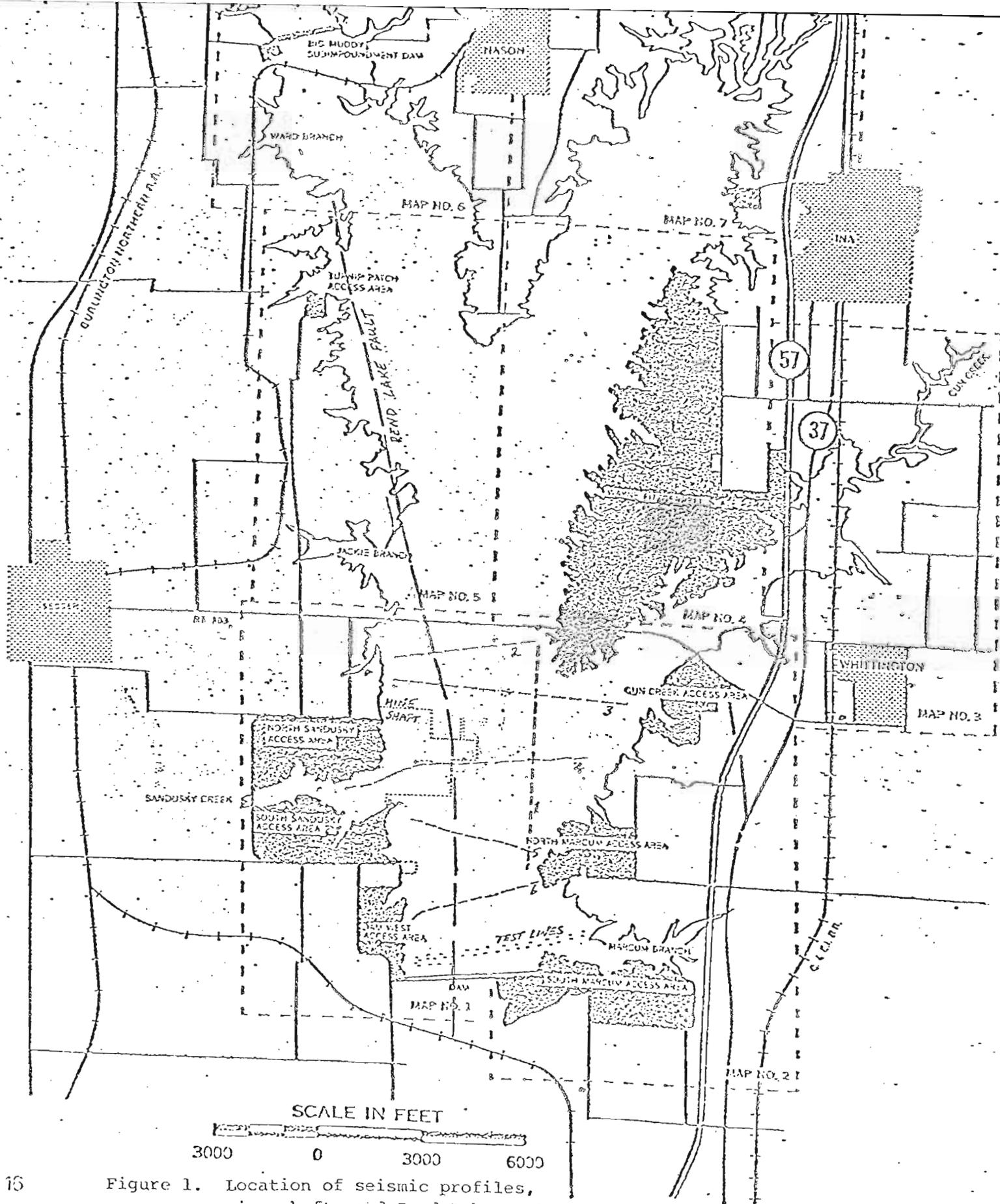
The U. S. Geological Survey, under contract to the U. S. Bureau of Mines, is developing a system to detect potential inundation hazards to be used in coal mining safety determination. High resolution profiles, supplemented by confirmation drill holes, would be used to delineate potentially hazardous geologic discontinuities.

Rend Lake, a man-made reservoir in southern Illinois, was chosen for the initial study because it is located in a region of extensive coal mining. Mine tunnels extend beneath the lake and cross a fault zone, the Rend Lake Fault. A multichannel high resolution reflection survey will be used to confirm the existence of the fault seismically, determine the age of most recent movement, and determine the potential of inundation along the fault.

The purpose of this preliminary survey was: (1) define survey requirements according to bottom conditions and water depth, (2) determine feasibility of bringing Neecho and twelve channel streamer into the lake, and (3) find locations for miniranger navigation stations.

EQUIPMENT

The preliminary survey was conducted from 21-23 May, 1980, using a 20 ft scow provided by the Army Corps of Engineers. U.S.G.S. personnel were Frank Jennings, Paul Loud, and Kathy Kent. Approximately 15 miles of 35 joule minisparker and 100 joule uniboom data were collected (Figure 1) and displayed, using a split sweep, on an EPC recorder. The sparker and uniboom were triggered together because the sparker would not fire



15 Figure 1. Location of seismic profiles, mine shaft, and Rend Lake Fault Rend Lake, Illinois

independantly. The EPC display on the average was:

Channel A - sparker and uniboom, Innerspace amplifier at 300-6000 Hz, 1/2 sec trigger, 1/8 sec sweep, 15 element U.S.G.S. non linear streamer (note: streamer was folded into thirds in an attempt to improve resolution.)

Channel B - sparker and uniboom, Teledyne amplifier at 175 Hz-OPEN, 1/2 sec trigger, 1/8 sec sweep, 3 element AQLA streamer.

Both the sources and streamers were kept at the lake surface, with a separation of about 20 ft.

Navigation consisted of hand compass bearings taken on landmarks located on shore. Positions are approximate because of errors in compass readings and difficulties locating landmarks on topographic maps.

#### SUMMARY

Data quality was poor because of strong multiples and noisy water column. The lake is very shallow, averaging 25 feet deep but shoaling to less than 5 feet. The outgoing pulse, of both sparker and uniboom, was very long, sometimes obscuring the bottom return. Additional noise problems were caused by the boat as both sources and streamers were trailing in the wake.

The lack of penetration is critical. Rend Lake Fault was crossed five times but was not observed on the records. However, fault displacements are small, maximum of 55 feet, and it is not known to disrupt the Pliestocene to Recent cover (Nieto and Donath, 1976; Keys, 1978).

In most areas six to eight multiples were displayed indicating a hard or highly reflective bottom. Literature suggests that the lake is underlain by 10-60 feet of Pleistocene till and lake deposits consisting of clay, silt, and very fine sand (Nieto and Donath, 1976). Bedrock, though seldom exposed, consists of Pennsylvanian shales with minor sandstone and limestone (Nieto and Donath, 1976). Hopefully the 12 channel system and a lower frequency sound source will provide the

necessary penetration to observe the fault.

Problems involved with bringing Neecho and the 12 channel streamer into the lake, and setting up miniranger navigation stations are being addressed by Frank Jennings and Paul Loud.

#### REFERENCES

Nieto, Alberto S., and Donath, Fred A., 1976, Report of a Study of Structural Geology and Subsidence of Rend Lake Dam Areas, Franklin and Jefferson Counties, Illinois: for U. S. Army Engineer District, Corps of Engineers, St. Louis, Missouri, 49 p.

Keys, John N., 1978, An Analysis of the Rend Lakes Fault System in Southern Illinois: M.S. Thesis, University of Illinois at Urbana - Champaign, 59 p.