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Status Report

EQUIPMENT FOR OUTCROP STUDIES

Project BE1

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EQUIPMENT FOR OUTCROP STUDIES

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SUMMARY

The objective of the NIPER reservoir characterization research program is to develop a methodology to describe reservoirs well enough to predict the residual oil saturation (ROS) at all points in reservoirs and the flow patterns of injected and produced fluids given the location of injection and production.

The research plan is designed to improve reservoir descriptions by quantitative geological analysis of critical heterogeneities which markedly affect fluid flow pattern by use of both outcrop and reservoir data.

One of the important decisions concerning the outcrop study was whether extensive outcrop coring would be necessary or whether knowledge of field permeameters and limited sampling would be adequate. Extensive outcrop coring which allows much more intensive measurement and evaluation of physical and chemical properties of the outcrop cores was selected. The next task of the program was to determine and prepare adequate equipment and methodology for outcrop sampling and measurements. This report provides a check list for the optimum equipment requirements based on the experience acquired from a preliminary field trip to Shannon sandstone outcrops in Wyoming during October 1985. The equipment needed, most of which is already available at NIPER, can be classified as field equipment and laboratory equipment.

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FIELD EQUIPMENT

Field equipment needed for outcrop sampling is as follows:

Vehicles, preferably a truck, modified for storing and transporting the equipment listed below, and a 4-wheel drive field car with winch.

Electric generator, truck-mounted or (preferably) portable, rated at least 1,500 watts.

Motorcycle batteries (12 v) in portable enclosures for less accessible areas.

Surveying equipment (tripods, compasses, theodolyte, field polarizing microscope, field altimeter, mirror stereoscope, measuring tapes and rods). For efficient sampling, the surveying of the outcrop and marking of the coring locations should be performed before the coring operation begins.

35-mm cameras, minimum two, with color and black and white film. Slide and print film. Telephoto/Zoom (200 mm or more), normal and wide-angle (25 mm) objectives. Closeup lens or macrolens. Flexible objective for compensating for perspective distortions.

Field permeameter.

Geiger-Muller counter.

Rock saw with spare cutting wheels, sledge hammer, breaker bars, and steel wedges for removing rock. Given the difficulty of rock block cutting and removal, only a small number of blocks will be cut for heterogeneity studies.

Portable coring machines, (at least two) with the capability of taking cores of at least 1 inch diameter. The capability for drilling larger

core plugs (2 in. in diameter) should be provided to study the dependence of the variability of permeability and porosity on core plug size. Air compressors (both 110 V, ½ HP and smaller 12 V) for dry drilling or water pump for wet drilling, hoses, and connectors. Our experience with two borrowed Pomeroy portable coring machines was highly satisfactory. They are designed to handle both 1-inch and 2-inch core barrels.

Coring diamond tipped bits, 1-inch and 2-inch diameter.

Core packaging materials (bags, containers, boxes, tape, markers). Our original procedure of individually marking and wrapping the cores was as time-consuming as the actual core drilling. A faster, more efficient packing and labeling procedure has been adopted.

Rock climbing equipment, including ladders (at least 30 ft) and climbing ropes. The ropes are needed both for safety and for reaching locations not accessible from ladders.

Communications equipment (weather radio, walkie-talkies, CB radio, police band two-way radio).

Specially equipped first aid kit and stretcher.

Appropriate clothing and hiking boots and backpacks. Should offer adequate protection from excessive heat or cold, wind, insects, and snakes, but not interfere with work.

Protective equipment (hard hats, goggles, face shield, dust masks).

Miscellaneous (geologic hammers, waterproof notebooks, rock marking pens, hardness sticks, binoculars, electrical extension cords, geologic and topographic maps, HCl bottles).

Tools for light mechanical, electrical, and auto repair work.

As the outcrop sampling work presents possibilities of injuries, all personnel involved should be thoroughly trained in the use of the equipment and mountain climbing procedures. Completion of a rock-climbing course and a CPR course are requirements.

LABORATORY EQUIPMENT

The necessary laboratory equipment is as follows:

Core cutting saw should be equipped with hood and appropriate air ventilation.

Permeameter (gas and liquid). At present we can handle up to 1½-inch diameter cores. Larger diameter core holders will be acquired as needed. A low-pressure manometer was installed for handling measurements of high-permeability cores.

Porosimeter.

Core microscope with reflective light.

Petrographic microscope with fluorescence microscopy.

Photomicrography equipment.

Goniometer.

Digitizing tablet, to be used to store information numerically on pore and particle sizes from thin sections, as well as sizes and shapes of outcrop related occurrences (fractures, shale breaks, bedding planes, etc.). After much delay, we received the software which allows the digitized information to be stored in an IBM PC microcomputer, and it is being tested.

Automatic point counter.

Scanning electron microscope.

X-ray diffraction equipment.

Data-processing equipment and software (microcomputer, printer, plotter, modem, statistical software package).

This laboratory equipment allows for core plug permeability and porosity measurements, thin section petrography (mineralogy, texture, structure, and diagenesis), geometry, size and distributions of particles, pores and pore throats.

After similar measurements are performed on reservoir cores, outcrop and subsurface cores will be compared.

Most of the equipment listed is available at NIPER. Other items, are either being ordered or will be rented locally (e.g., the 4-wheel drive vehicle). Some laboratory equipment (large core permeameter) was constructed at NIPER.

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