oil-shale sections than other methods. Much less rock per barrel of oil is mined by the Occidental process than in other processes. The process is environmentally attractive in that surface installations are kept to a minimum because a surface retort is not required. Rock mined is readily revegetated raw oil shale.

CURTIS, GRAHAM, Gulf Minerals Resources Co., Denver, Colo.

ENVIRONMENTAL GEOLOGY AND LEGISLATION AND EFFECT ON EXPLORATION AND PRODUCTION

No abstract available.

DOLE, HOLLIS M., Colony Development Operation—Atlantic Richfield Co., Denver, Colo.

TITLE TO BE ANNOUNCED

No abstract available.

DUNN, C. E., Saskatchewan Dept. Mineral Resources, Regina, Sask.

UPPER DEVONIAN DUPEROW SEDIMENTARY ROCKS IN SOUTHEASTERN SASKATCHEWAN—WHY NO OIL YET?

Although oil shows are common in the 500 to 700 ft thick Duperow Formation (Frasnian) of southernmost Saskatchewan, no commercially viable accumulations have been found. However, a few miles south of the Canadian border producing fields are present in Montana.

The sedimentary rocks comprise more than 20 carbonate/evaporite cycles with potentially good reservoir rocks—sucrosic dolomites, oolites, and vuggy carbonates. The inhibiting factors to hydrocarbon accumulation are: (1) extensive anhydritization plugging pore spaces; (2) halite plugging vuggy carbonates in the upper Duperow; (3) many vertical fractures, now plugged by anhydrite, but good potential escape routes for fluids in the past; (4) absence of oolite developments more than 2 ft thick.

These factors explain the lack of success to date. However, the Duperow still is considered a good prospect because: (1) good porosity and oil staining are common in two zones near the middle of the Duperow section; (2) only 180 wells have penetrated the Duperow over an area of 15,000 sq mi—35% of these have terminated above the porous zones, sometimes on seismic highs where the prospect was obviously the overlying Birdbear Formation, a known producer; (3) vuggy carbonate rocks may not always be halite plugged in an area southwest of a major halite body; (4) isopach maps show that extensive solution of Middle Devonian Prairie Evaporite salts took place in Duperow deposition causing locally anomalous accumulations of Duperow sediments. Structure contour maps indicate northwest and northeast trends of the anomalies. These trends are strongly emphasized in a computer-plotted third-degree residual trend surface analysis map. A major northeast lineament lines up with the Duperow fields in north Montana. Conjugate sets of weakness in the Precambrian basement may have caused these trends, and their intersections are the most likely prospects for Duperow oil.

FUZESY, L. M., Saskatchewan Dept. Mineral Resources, Regina, Sask.

GEOLOGY AND HYDROCARBON POTENTIAL OF WINNEPEGOSIS FORMATION IN SOUTHERN SASKATCHEWAN

No abstract available.

GEORGE, GENE R., Runge, Campbell & George, Casper, Wyo.

POISON DRAW FIELD, CONVERSE COUNTY, WYOMING

Oil and gas production in Poison Draw field, discovered in 1972, is from the lower sand bed of the Teckla sand member of the Lewis Shale (Late Cretaceous). Oil production has passed the one-million-bbl mark and is expected to exceed eight million bbl of primary production.

The pool is contained in a stratigraphic trap formed in a delta-front environment where strong long-shore currents and wave action formed a northwest-southeast trending system of beaches and delta-front bars. The Poison Draw Teckla pool produces from an undersaturated, underpressured sandstone reservoir.

Development drilling on the east updip margin and in the northern part of the field is still active. The recent increases in crude oil prices have greatly enhanced the economic potential of the field.

One other Teckla sand pool already has been found and further exploration drilling may find additional Teckla sand pools in the southern Powder River basin.

GLASS, GARY B., Wyoming Geol. Survey, Laramie, Wyo.

USE OF PUBLISHED WYOMING COAL ANALYSES

Published proximate analyses, heat values, and sulfur contents of representative Wyoming coals were compared by sample types (face, tipple, and delivered) and by mining methods (underground and strip). These comparisons suggest that the quality of thick, potentially strippable Wyoming coals should not be characterized too stringently from published proximate analyses and heat values without consideration of detailed background information on each analysis. Minimally, the type of sample, date of analysis, sizes sampled, description of coal, thickness and part of coal sampled and/or discarded, type of mine, mining equipment, preparation facility, processing, and even customer identification should be known.

This precaution is deemed necessary for the following reasons.

1. Although analyses of face samples best characterize a coal bed in its natural state, most published analyses of Wyoming coals are either very old face samples from abandoned underground mines or they are tipple and delivered samples.

2. Most available face, tipple, and delivered samples of thick coals (35-118 ft thick) are only representative of one fourth to one half of the entire thickness of such beds.

3. For a given coal bed, there are not enough surface mines for which analyses are available to charac-

terize reliably the quality of strippable reserves.

4. For a given coal bed, tipple and delivered samples from strip mines tend to exhibit lower average moisture contents (as-received basis), higher average ash contents (dry basis), as well as greater ranges in ash contents, and less predictable average heat values (dry basis) than expected.

5. Although for many coals tipple and delivered samples are available from both surface and deep mines, analyses of these types of samples are so dependent on the type and use of mining equipment, preparation facilities, processing, and contract specifications that they may only by chance bear a close resemblance to the coal in its natural state.

Apparently only a coal's sulfur content can be characterized accurately from existing published analyses of face, tipple, or delivered samples, as no significant differences were noted in any of the comparisons.

HANSINK, JAMES, Union Pacific Mining Corp., Denver, Colo.

CHANGING TRENDS IN URANIUM EXPLORATION

The concept so prevalent in the late 1940s and 1950s that "Uranium is where you find it" is no longer valid. Housewives and cowboys no longer find uranium orebodies. Modern uranium exploration requires a broadly based approach, well-founded on geologic, geophysical, and geochemical techniques, and one which is supported by an informed and aggressive management structure.

Methods of exploration based on flexible models of ore genesis and designed to evaluate large geologic provinces rapidly have been developed. Selective use of geophysical and geochemical tools help to define targets within a favorable province. Careful geologic mapping, sampling, and data interpretation lead to preliminary drilling and interpretation of favorable areas, usually with little or no evidence of surface mineralization. In contrast to this approach, European exploration organizations have, with government subsidy, evolved a domestic exploration philosophy built around extremely detailed surface techniques and saturation drilling of target areas. Only some of the differences in approach are explained by the different types of orebodies found.

Both of these approaches have been successful in their respective areas of use.

Fundamental to the success of any uranium exploration program in the future will be increased reliance on skillful and creative three-dimensional thinking by the technical man. As in the oil industry, the easy ones have been found, but in uranium, the "plums" remain.

HARKSEN, J. C., South Dakota Geol. Survey, Rapid City, S.D.

UNDRILLED STRUCTURES IN SOUTH DAKOTA

No abstract available.

HOUSTON, R. S., and RONALD W. MAARS, Univ. Wyoming, Laramie, Wyo.

EXAMPLES OF USE OF STANDARD DATA PRODUCTS OF NASA-ERTS, SKYLAB, AND AIRCRAFT PROGRAMS IN STUDY OF WYOMING SURFACE RESOURCES

Cloud-free imagery of the State of Wyoming is available from the NASA programs; ERTS (complete coverage at 560 mi), Skylab (50% ± coverage at 265 mi), and aircraft (60% ± coverage at altitudes ranging from 15,000 to 60,000 ft). Standard data products available to the public include images or photographs of scenes recorded in different bands of the spectrum and in infrared and color. Many potential users (for example, consultants, small companies, and independent geologists) are limited to visual methods of analyses of these products. Wyoming studies have employed these standard data products for a variety of geologic and economic applications: regional geologic mapping for updating and correcting existing maps and as an educational tool; illustrations of the value of seasonal images in geologic mapping; specialized mapping of such features as sand dunes, playa lakes, lineaments, glacial features, regional facies changes, and their possible economic value; and multilevel sensing as an aid in mineral exploration. Cooperative studies between botanists, plant scientists, and geologists for the preparation of maps of surface resources can be used by planners and for environmental impact studies. These maps are especially useful in areas, such as the Powder River basin of Wyoming, facing critical environmental problems that will result from the development of energy resources.

The various studies illustrate that certain user requirements can be met satisfactorily with ERTS and Skylab alone, but that others require higher cost (to the user) aircraft and ground data or special data-enhancement techniques. Perhaps the key point, however, is that the NASA system has given us both complete and sequential regional coverage at a critical time in our effort to assess the effects of resource development.

KEEFER, W. F., and RICHARD F. HADLEY, U.S. Geol. Survey, Denver, Colo.

RESOURCE AND LAND INFORMATION APPLIED TO POTENTIAL COAL DEVELOPMENT IN GILLETTE AREA, WYOMING

Some of the world's largest known coal deposits are present in the Gillette area, Wyoming. Recent demands for increased production of these resources emphasize the need for sound land-use planning, resource management, and environmental protection if future development is to be guided in the best public interest. Accordingly, the U.S. Geological Survey has begun a program of integrated geologic, hydrologic, and related studies to acquire basic land, water, and resource data. The results of the investigation are being prepared and published in forms designed for ready understanding by a wide range of potential users.

The study covers 1,500 sq mi in central Campbell County, and focuses on: (1) current land use and land and coal ownership; (2) location and extent of coal resources; (3) surface and ground water resources; and (4) potential environmental impacts of surface mining.

Geologic mapping and drill data indicate the presence of nearly a dozen individual coal beds of economic interest, parts of which are strippable. The Wyodak-Anderson coal bed is the deposit of greatest interest. This bed averages 50 to 100 ft in thickness in many places, lies less than 200 ft deep over approximately 75,000 acres of the study area, and contains more than 7 billion tons of sub-bituminous coal in the area where the overburden is less than 200 ft thick.