new geologic concepts; and (4) boundaries between communication barriers, *i.e.*, intercompany, intracompany, government *versus* industry, communication breakdown between explorationists and their management, and between research and exploration organizations. The structural and stratigraphic papers, especially, will emphasize the regional aspects. The regional settings, provenance, depositional environment, and related facies will be presented without particular regard to present geographical boundaries. In addition to papers dealing with stratigraphy, structure, and oil exploration problems, talks dealing with lunar geology, the use of nuclear explosives in oil and gas production, natural steam resources, oil-field fires, tar sands, oil shale, coal, and uranium will be presented.

One field trip on October 8 will be conducted through the Casper Mountain-Alcova area south of Casper. This trip will illustrate the structure and stratigraphy of formations ranging in age from Precambrian through Late Cretaceous.

The keynote address will be given by THOMAS D. BARROW, Vice President and member of the Board of Directors of Humble Oil and Refining Co. JOHN B. CARRIER, Champlin Petroleum Co., Casper, is president of the Rocky Mountain Section. JOHN S. RUNGE, Independent, Casper, is general convention chairman, and ROBERT H. STEED, Marathon Oil Co., Casper, is program chairman. Following is a tentative program summary.

TECHNICAL PROGRAM SUMMARY

MONDAY, OCTOBER 9, 1967

1. Keynote address, by THOMAS D. BARROW
2. President's address, by JOHN B. CARRIER
3. Exploration management, ESP or IBM?, by JACK HENDRICKSON
4. Western cordillera—Alaska to Mexico, by ARMAND J. EARDLEY
5. Regional Precambrian tectonics and stratigraphy of Rocky Mountains with emphasis on Wyoming province, by ROBERT S. HOUSTON
6. Habitat of oil in Rockies, by WILLIAM CURRY, III
7. Use of nuclear explosives in oil and gas production, by H. F. COFFER, H. E. GRIER, AND H. H. ARONSON
8. Cambrian history of western United States, by ALLISON R. PALMER
9. Contribution of computers to exploration—management viewpoint, by J. EDWARD GREEN
10. Computer as aid to geologic communication, by ROBERT W. MEADER
11. Quantitative environmental analysis of a Lower Cretaceous reef complex, by L. S. GRIFFITH, MAX G. PITCHER, AND G. W. RICE
12. Geology of the Moon (based on satellite photographs), by N. JAMES CLINTON

TUESDAY, OCTOBER 10, 1967

13. Pre-Pennsylvanian—post-Cambrian geology of Cordilleran trough, by RALPH LANGENHEIM, JR.
14. Regional Ordovician stratigraphy of Rocky Mountain region, by J. R. PATTERSON
15. Devonian geology of Canada, Montana, and Wyoming, by GORDON BASSETT AND JOHN STOUT
16. Middle Devonian facies relation, Zama area—Alberta, Canada, by JOHN MCCAMIS AND L. S. GRIFFITH
17. Devonian-Mississippian stratigraphy of western Mid-Continent area, by EDWIN D. GOEBEL AND PAUL L. HILPMAN
18. Isotasy and overthrusting in western Wyoming, by GARY W. CROSBY
19. Spectacular oil-field fires, by RED ADAIR
20. Geothermal energy, by MERRILL J. REYNOLDS
21. Mississippian geology of Canada and Williston basin, by GEORGE MACAULEY
22. Mississippian and Pennsylvanian stratigraphy in middle and southern Rocky Mountains, by WILLIAM W. MALLORY
23. Pennsylvanian geology of western Mid-Continent, by DONALD C. SWANSON
24. Exploration progress in Alaska, by N. N. REQUIST
25. Breaking geological communication barriers, by JOHN W. ROLD
26. An astronaut

WEDNESDAY, OCTOBER 11, 1967

27. Future role of Rocky Mountain coal, by PAUL AVERITT
28. Permian System of southern Rocky Mountains and surrounding provinces, by JAMES A. MOMPER
29. Bank-to-basin transition in Permian (Leonardian) carbonates, Guadalupe Mountains, Texas, by PAUL N. MCDANIEL AND LLOYD C. PRAY
30. Triassic-Jurassic of Alberta, Saskatchewan, Manitoba, Montana, and North Dakota, by C. E. CARLSON AND H. A. GIBSON
31. Jurassic and Triassic of Wyoming and southern Rockies, by GEORGE N. PIPIRINGOS
32. Lower Cretaceous of Montana, North Dakota, and Canada, by R. A. RUDKIN
33. Lower Cretaceous of Wyoming and southern Rockies, by ROBERT G. YOUNG
34. Marine and channel sandstones in Lower Cretaceous of D-J basin, by JOHN HARMS AND FRANK EXUM
35. Geology of Canadian heavy oil sands, by L. W. VIGRASS
36. Bituminous sandstone deposits of Utah, by HOWARD RITZMA
37. Rates of sedimentation and intrabasin deformation, Upper Cretaceous, Rocky Mountain region, by ROBERT J. WEIMER
38. Tertiary Fort Union Formation of northern Rockies, by W. A. SEARS, JR., AND JOHN J. SULLIVAN
39. Tertiary Wasatch-Green River Formations of western Wyoming, Utah, and western Colorado—oil and gas, by ROBERT MCDONALD
40. Eocene Green River Formation—multiple mineral resource, by W. C. CULBERTSON, J. R. DYNI, AND D. A. BROBST
41. Tertiary Wind River Formation—uranium resources and geology, by R. D. ADAMSON

ABSTRACTS

RED ADAIR

SPECTACULAR OIL-FIELD FIRES

(No abstract submitted)

R. D. ADAMSON, Homestake Mining Co., Casper, Wyoming

TERTIARY WIND RIVER FORMATION—URANIUM RESOURCES AND GEOLOGY

Sedimentary rocks of the Wind River Formation of early Eocene age and its equivalents (Battle Springs and Wasatch Formations) are the host rock for at

least 95% of the uranium reserves in Wyoming. Wyoming reserves were estimated by the AEC at 53,270 tons of U_3O_8 as of January 1, 1967. Distribution of reserves in tons of U_3O_8 together with production to January 1, 1967 are estimated as follows: Gas Hills, 19,560± tons reserve, 17,300 tons produced; Shirley basin, 27,000± tons reserve, 3,450 tons produced; Crooks Gap, 4,000± tons reserve, 2,400 tons produced; other Tertiary basins including Powder River, 1,000± tons reserve, 1,100 tons produced.

Wind River and equivalent rocks crop out in broad areas within the intermontane Tertiary basins of central Wyoming. The sediments that comprise these lower Eocene beds were derived from mountain ranges that were uplifted during Late Cretaceous through earliest Eocene times. Two facies predominate within the major basins. A coarse arkosic sandstone and conglomerate facies with interbedded siltstone dominates near the mountain fronts. Major uranium deposits occur in this facies. Farther out in the basins the coarse-grained sediments grade into or interfinger with a variegated fine-grained facies.

Economic concentrations of uranium occur near the margins of tongues of altered sandstone within the coarse-grained facies and are classified as roll-type deposits. Character of alteration differs from basin to basin but has been recognized to some degree in all basins. Alteration consists of the oxidation products produced by mineralized ground water passing through a transmissive sandstone bed. Geometrically the deposits are tongue-shape in plan and crescent-shape in vertical section with the concave side toward the altered sandstone.

Deposition of uranium occurred at the front of an advancing aqueous chemical system which moved through the host sandstone bed. The oxygenated water rich in uranium, selenium, and other trace elements moved along the hydrologic gradient and oxidized and leached various minerals, including uranium, as it progressed. Precipitation of the uranium and associated elements occurred at a point within the aquifer where the pH and Eh of the system dropped sharply. The change in chemical environment was the result of the presence of H_2S, probably produced by anaerobic bacteria.

AN ASTRONAUT

(No abstract submitted)

PAUL AVERITT, U. S. Geol. Survey Fuels Branch, Denver, Colorado

Future Role of Rocky Mountain Coal

(No abstract submitted)

THOMAS D. BARROW, Humble Oil Co., Houston, Texas

Keynote Address

(No abstract submitted)

GORDON BASSETT, Shell Oil Co. of Canada, Ltd., Edmonton, Alberta, and JOHN STOUT, Chevron Oil Co., Denver, Colorado

Devonian Geology of Canada, Montana, and Wyoming

(No abstract submitted)

C. E. CARLSON, Mobil Oil Canada, Ltd., Calgary, Alberta, and H. A. GIBSON, Mobil Oil Company, Casper, Wyoming

Triassic-Jurassic of Alberta, Saskatchewan, Manitoba, Montana, and North Dakota

Of the Triassic-Jurassic Systems, only Lower Triassic was deposited in southern Saskatchewan, North Dakota, and southern Montana. Thicknesses in excess of 700 ft are present in western North Dakota reflecting the depocenter of restricted salt basins. On the basis of lithologic correlation, the lower Watrous Formation in Saskatchewan is considered to be equivalent to the upper part of the Spearfish Formation in North Dakota. Lower Middle and Upper Triassic rocks in western Alberta are of marine origin, attain thicknesses in excess of 4,000 ft, and produce oil and gas.

Jurassic rocks are widespread throughout the map area as a result of Jurassic seas transgressing from the northwest along the Eastern Cordillera, then spreading east across Montana into the Williston basin. Lower Jurassic formations in the map area are restricted to southwestern Alberta. Middle Jurassic formations are the most widespread, and are thicker than 500 ft in a depocenter in southeast Saskatchewan and northwest North Dakota. Similar thicknesses are present in the Alberta trough. Upper Jurassic sediments also are widespread, reaching thicknesses of 7,000 ft in the Eastern Cordillera of Alberta and more than 700 ft in eastern Montana.

Economic deposits of coal, gypsum, oil, and gas occur in Middle and Upper Jurassic formations. Oil is the most significant, particularly in southwestern Saskatchewan where 20 fields are estimated to have ultimate production of 347 million bbl. These fields produce in stratigraphic traps, primarily from sandstone associated with shoreline facies.

N. JAMES CLINTON, Lockheed Electronics Co., Houston, Texas

Geology of the Moon

At present, most knowledge of detailed geologic conditions on the moon is limited geographically to the photographic missions of the Lunar Orbiter program which has primarily covered the Apollo Zone. Complications caused by albedo, high sun elevations, and electronic imagery distortion hamper photo interpretation.

The lunar stratigraphy is divided into four systems: pre-Imbrian-highlands ringing the oldest mare; Imbrian—the oldest lowland mare; Eratosthenian—"eroded" crater material; and Copernicus-recent crater material.

Ubiquitous craters appear to be formed by both impact of meteors and volcanic activity. Faults, slump or creep, flowage—all appear to be present on the lunar surface.

Synoptic orbital photography of the earth is a logical outgrowth of the lunar program. Use of synoptic photography will improve exploration geologists' understanding of their individual areas of interest as they relate to the regional geologic setting.

Geologic processes and theories developed on earth will aid the interpretation of morphological and structural conditions on the moon. Likewise, technologies developed from the lunar and planetary program will aid exploration on the earth.

H. F. COFFER, CER Geonuclear Corporation, Las Vegas, Nevada, H. E. Grier, and H. H. Aronson

Use of Nuclear Explosives in Oil and Gas Production