orado; and (2) biostratigraphy and correlation of part of the Tongue River Member of the Fort Union Formation, northern Powder River basin, Wyoming and Montana.

The Green River and Wasatch Formations are complexly intertonguing lacustrine and fluvial units that were deposited during early and middle Eocene time in Western Interior basins of Wyoming, Colorado, and Utah. The structure of nonmarine molluscan associations within these strata delineates littoral and sublittoral lacustrine, pond, fluvial, and terrestrial habitats. Littoral and sublittoral lacustrine habitats are characterized by a low-diversity association of prosobranch gastropods and unionid bivalves. Rank and relative abundance of taxa differ in these habitats. Ponds are dominated by a diverse association of aquatic pulmonate gastropods with sphaeriid bivalves. Lowland and flood-plain habitats are characterized by a locally diverse association of terrestrial pulmonate gastropods and a fluvial association dominated by unionid bivalves with prosobranch and aquatic pulmonate gastropods. Comparison with structurally similar molluscan associations from modern habitats, paleosynecology of fossil taxa, and lithostratigraphic data provide bases for paleoenvironmental interpretation. Analysis of paleogeographic and stratigraphic distribution of these Eocene molluscan associations, relative to a detailed lithostratigraphic framework, permits regional paleoenvironmental reconstruction within the Green River and Wasatch Formations.

In the northern Powder River basin, the Tongue River Member of the Fort Union Formation contains diverse, commonly excellently preserved assemblages of Paleocene nonmarine mollusks. Detailed study of the distribution of gastropods and bivalves in the stratigraphic interval from below the Wall coal bed to above the Arvada coal bed clearly indicates the value of mollusks in correlation of sedimentary sequences between the Wall, Anderson, Smith, Roland, and Arvada coal beds. Clinal morphologic variation in shell form and sculpture through time within a lineage of viviparid gastropods provides an additional method for correlation within part of the stratigraphic interval.

These studies clearly indicate the value of mollusks in the interpretation of depositional environments, biostratigraphy, and correlation of Paleogene nonmarine rocks.

HARMS, J. C., Marathon Oil Co., Littleton, Colo.

Alluvial-Plain Sediments of Nubia, Southwestern Egypt

Nubia sandstone strata of southwestern Egypt were deposited mainly on vast alluvial plains with a northward slope and range in age from Jurassic to latest Cretaceous. The unique aspects of the Nubia as compared to most published fluvial models are that: (1) the sequence is composed almost entirely of medium to coarse-grained sand through a thickness of 1,000 to 2,000 m, (2) the stream channels were relatively straight, commonly only 2 to 4 m deep, and occupied by sand-wave bed forms, and (3) the overbank deposits were thin, sandy, and contain fine kaolin clay plates introduced by infiltration of muddy flood waters.

The typical Nubia fluvial cycle is simple and of two parts. The lower part, commonly 2 to 4 m of porous clay-free sandstone, is composed of tabular sets of cross strata 20 to 100 cm thick, with consistent north dips. The upper part, only 1 to 2 m thick, is also sandstone but contains abundant kaolin platelets 1 to 2 μ in size. These clayey sandstones have numerous root traces and commonly lack primary lamination, although remnants of tabular sets are rarely partly preserved. The contact between upper and lower parts is transitional, with downward decreasing root-trace abundance. The basal contact of each cycle is an erosional surface with slight relief, and commonly eroded clayey sandstone clasts are reworked into the overlying sandstone.

Environmental reconstruction suggests that alluvial plains sloped northward from northern Sudan for hundreds of kilometers toward the Mediterranean. The climate was warm and humid or semihumid, judging from the flora. Streams crossing the plain were mostly fairly small, shallow, straight, but not braided. Interchannel areas were densely vegetated by plants typical of the Jurassic and Cretaceous. The sandstone is nearly pure quartz, although the source area is largely crystalline basement. This mineralogic maturity testifies to rigorous weathering and a long time span for fluvial recycling. Three alluvial plain sequences, each several hundred meters thick, are separated by thin marine or marginal marine muddy sediments deposited during extensive southward transgressions into Egypt.

HAUN, JOHN D., Colorado School of Mines and Barlow & Haun, Inc., Golden, Colo.

Oil and Gas Potential of Wyoming

Through 1978 Wyoming had produced 4.6 billion bbl of oil and had a year-end estimated 1.8 billion bbl in known fields (includes proved reserves, NGL, future extensions, revisions, new-pool discoveries, and enhanced recovery). Production and reserves are between 3 and 4% of United States totals. Approximately 55% of past oil production has been from Paleozoic rocks, primarily Permian-Pennsylvanian, and 35% from Cretaceous sandstones. Reserves in Cretaceous rocks probably are greater than those in Paleozoic rocks, but the importance of Jurassic reservoirs is increasing. Three-fourths of past discoveries have been in structural traps, but, with the exception of the thrust belt, future discoveries will be largely in stratigraphic traps.

Through 1978 Wyoming had produced 7.6 Tcf of natural gas and had an estimated 9.8 Tcf in known fields (includes proved reserves, future extensions, revisions, and new-pool discoveries). Production and reserves are between 1 and 2% of the United States totals and are concentrated in Cretaceous sandstones—Cretaceous rocks in stratigraphic traps will dominate future production.

Average annual oil production during the past 20 years has been 139 million bbl. With reasonable economic incentives, future discoveries should permit production at this level to continue to the year 2000.

Average annual gas production during the past 20 years has been 300 Bcf. Development of known gas accumulations and future discoveries should permit an in-