

PALEOENVIRONMENTS AND PALEOECOLOGY OF THE  
GREEN RIVER FORMATION IN FOSSIL BASIN  
(FOSSIL BUTTE NATIONAL MONUMENT), WYOMING

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Objectives

In cooperation with Fossil Butte National Monument detailed paleontological and geological investigations of Eocene "Fossil Lake" (Green River Formation) were conducted during the summer of 1981. The principle objectives of this research are to determine the paleoenvironments and paleoecology of Fossil Lake by:

- 1) documenting the vertical stratigraphic distribution of the fossil biota and trace fossils;
- 2) determining the lateral variations in biota during a particular time interval;
- 3) mapping the lake deposits with particular emphasis on the extent of the "Lower Oil Shale Horizon" and approximate positions of the ancient shorelines, deltas, and islands; and
- 4) measuring stratigraphic sections and correlating important sedimentary units throughout the basin.

Methods

During the 1981 summer field seasons, five "mini-quarries" (approximately two meters square) were excavated to a depth of about one meter (see Fig. 2). Fossil types and their stratigraphic positions were recorded. Recoverable fossil material was collected and brought back to the lab for further study.

In addition, stratigraphic sections were measured and studied, the richest fish beds mapped throughout the basin, and stratigraphic units were correlated to allow reconstruction of facies diagrams and subsequent evaluation of depositional environments.

Results

Five quarries providing a margin to center cross-section were completed at the localities indicated in Fig. 1. They were all excavated at the same stratigraphic horizon ("Lower Oil Shale Horizon") as indicated in Fig. 2. Fossil fish, plants, and insects were recovered from these

Figure 1. Study and quarry localities in Fossil Basin, Wyoming.

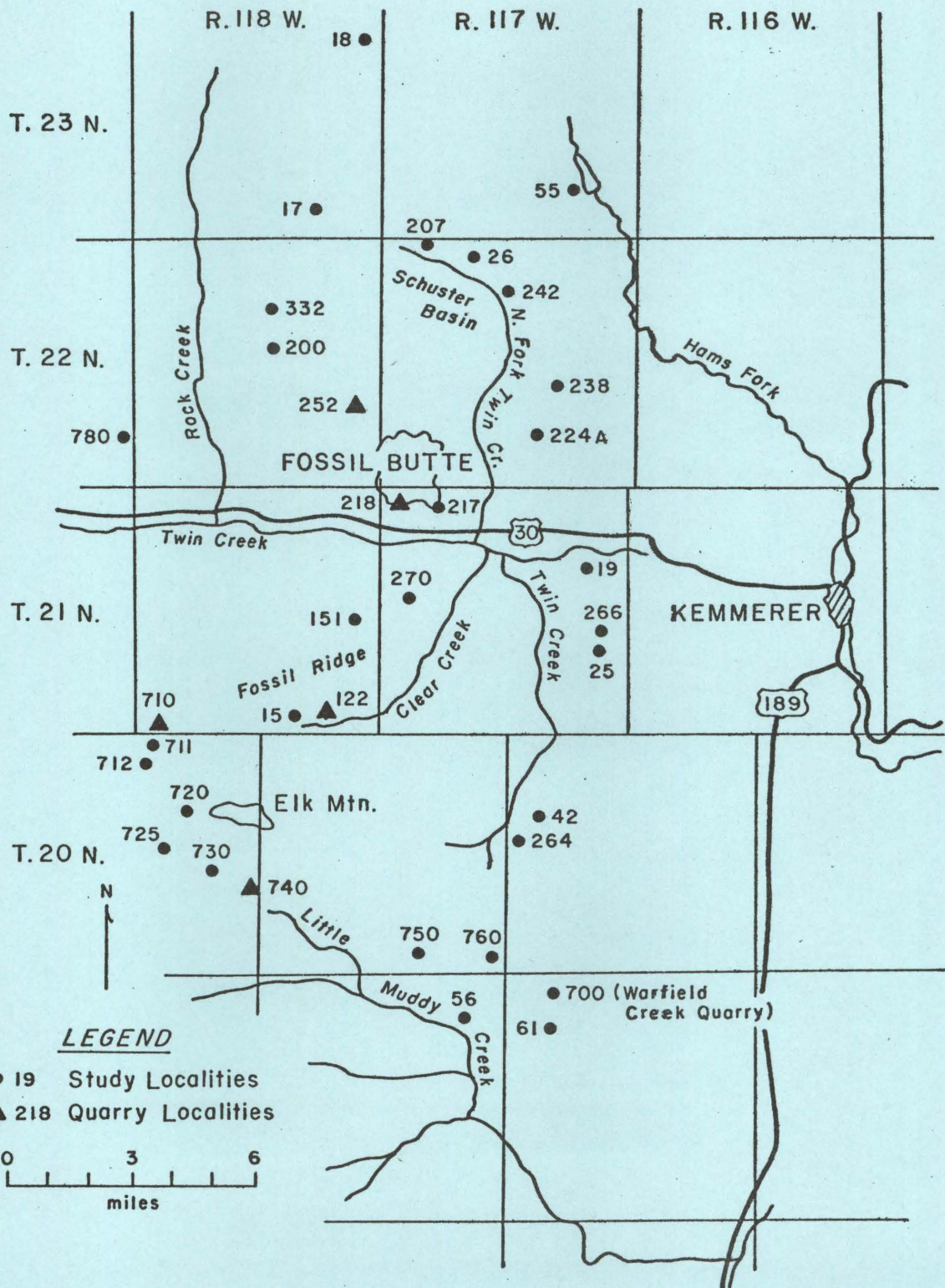
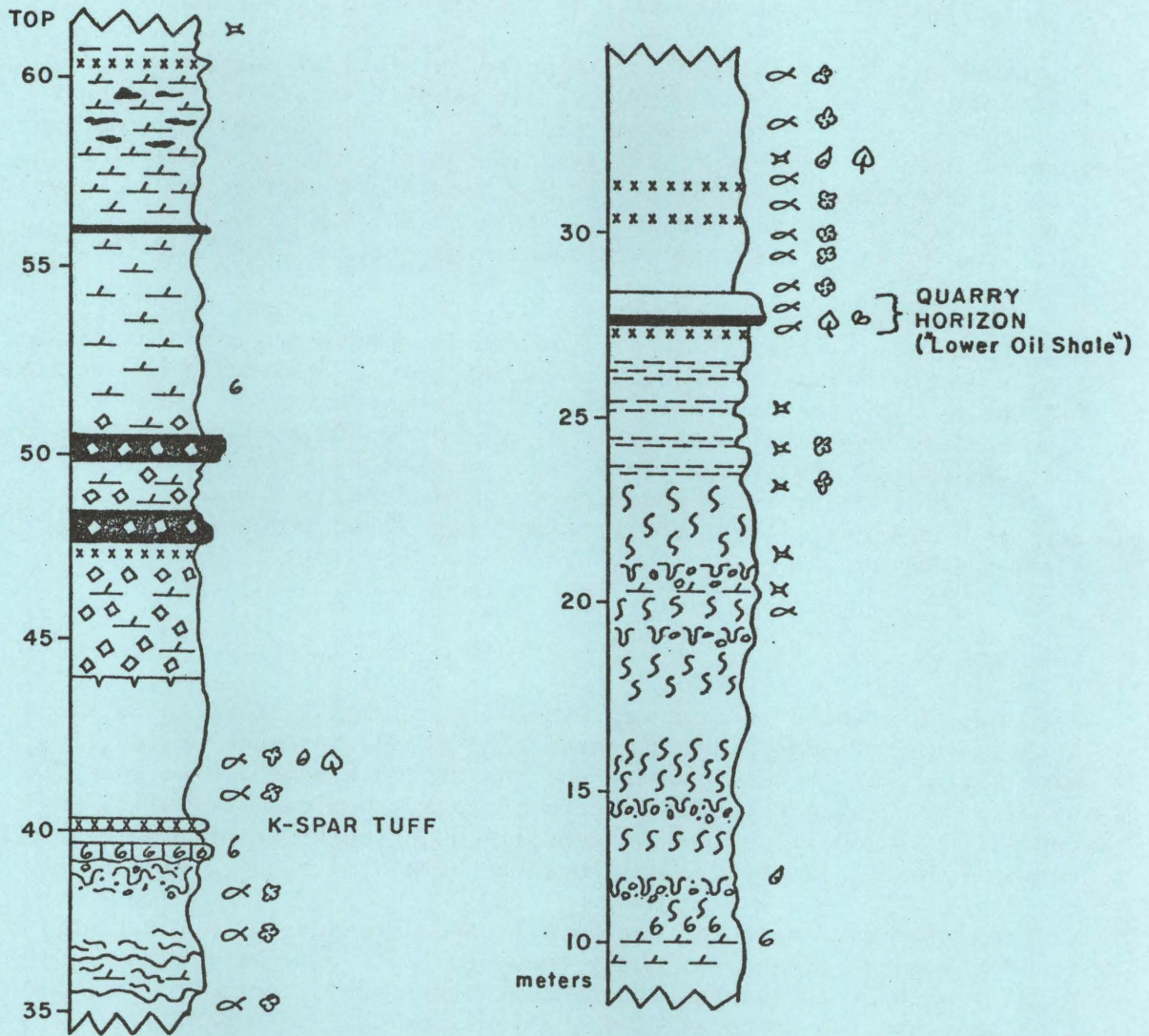


Figure 2. Stratigraphic section from locality 217, Fossil Butte showing quarry horizon.



**LEGEND**

- |  |                     |  |                         |  |                 |
|--|---------------------|--|-------------------------|--|-----------------|
|  | Laminated micrite   |  | Mudstone, siliciclastic |  | Fossil Fish     |
|  | Dolomicrite         |  | Ostracodal limestone    |  | Fossil Plants   |
|  | Bioturbated micrite |  | Tuff                    |  | Fossil Insects  |
|  | Disruption breccia  |  | Salt clasts             |  | Ostracods       |
|  | Oil shale           |  | Mudcracks               |  | Gastropods      |
|  | Pseudobreccia       |  | Chert                   |  | Fish coprolites |
|  |                     |  |                         |  | Fish fragments  |

quarries. These collections are presently being studied with completion of this phase (lateral analysis) of the study slated for June, 1982.

The Lower Oil Shale Horizon was selected for lateral comparisons of faunal and floral changes because it is readily traceable throughout the basin, it can be reached and excavated fairly easily, the rock splits comparatively well (good fissility), it contains abundant fossil fish, plants, and insects. It also provides good cross-section of rock types from well laminated micrite to oil shale, bioturbated micrite, and a rare coal layer at its base. This unit was mapped throughout Fossil Basin.

Other study localities (Fig. 1) provided information and field samples that allow detailed correlation of sedimentary units including the Lower Oil Shale, and provide a data base for paleoenvironmental reconstructions. Of particular interest is a volcanic tuff (K-spar Tuff, Fig. 2) that was mapped and studied in detail. It was found that it thins rapidly south of Schuster Basin (Fig. 1) indicating a nearby volcanic source or a fluvial input choked with volcanic ash forming a volcaniclastic "delta".

### Conclusions

The Lower Oil Shale Horizon represented the largest stand in Fossil Lake's history. Paleoenvironmental conditions were such as to allow a wide variety of fishes, plants, and insects to flourish. The specific details concerning relative numbers of taxa, chemical, climatic, and depositional conditions during deposition of the Lower Oil Shale are currently being assessed, and should be completed by June of 1982.

Related findings indicate that Fossil Lake extended further west by up to 10 kilometers than previously thought; that the lake initiated its history with a depo-center in the south that moved northward with time; that the lake was comparatively shallow (50-100 in. in depth); that a large delta dominated deposition in the south part of the basin; that the lake became more shallow, saline, and restricted in size with time; and that the lake experienced dynamic fluctuations in salinity, productivity, depth, and depositional environments through time. These conclusions differ significantly from that of McGrew and Casilliano (1975), and Bradley (1948), that suggest a static, deep, and permanently stratified lake.

### Literature Cited

- Bradley, W. H. 1948. Limnology and the Eocene lakes of the Rocky Mountain region: *Geol. Soc. America Bull.*, v. 59, p. 621-652.
- McGrew, Paul O. and Michael Casilliano. 1975. The Geologic History of Fossil Butte National Monument and Fossil Basin. National Park

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