was not, as previously supposed, a single depositional trough stretching from the Brooks Range to the Yukon delta but consisted of a narrow east-trending trough along the Kobuk and upper Koyukuk Rivers and a larger southwest-trending trough that extended from the lower Koyukuk River to the Yukon delta. The two troughs were separated by an east-trending geanticline along Lat 66° N. The volcanics and granitic intrusives of Late Jurassic and Early Cretaceous age that are now exposed along this geanticlinal trend were an important source of the sediments in both troughs.

Important data are also being developed by restudy of long-known Mesozoic terranes in southern Alaska. For example, the Talkeetna Formation of the southeastern Talkeetna Mountains was thought to consist mainly of marine volcanics of Pliensbachian (Early Jurassic) age. However, it is now known to range in age at least from early Sinemurian to late Toarcian. Radioactivity dates indicate that, in the Talkeetna Mountains, plutons began to be intruded into the Talkeetna Formation shortly after it was deposited. Intrusion began at about the time the Matanuska epi-eugeosyncline was established in earliest Middle Jurassic time within the area of the more extensive eugeosyncline of the Talkeetna Formation. Intrusion probably continued into Late Jurassic and possibly Early Cretaceous time, although the adjacent Matanuska geosyncline was concurrently receiving a relatively complete sedimentary section.

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PETROLOGY OF JEFFERSONVILLE LIMESTONE (MIDDLE DEVONIAN) OF SOUTHEASTERN INDIANA

Thin-section, polished-surface, and X-ray analyses of 500 samples collected from the Jeffersonville Limestone at 14 localities in southeastern Indiana have permitted detailed correlation of carbonate facies. The Jeffersonville can be subdivided into 5 zones, each with its characteristic fauna and carbonate rock types. These zones overlap one another successively from south to north.

1. The lowest, or coralline zone, contains 3 distinct carbonate rock types, including (ascending) grain-supported biomicrite, biosparite, and biomicrudite. The lower biomicrite and biosparite units contain many branching corals, large colonial corals, and mound-like stromatoporoids. These fossils are found both *in situ* and overturned but generally are not fragmented. The upper biomicrudite contains a profusion of solitary corals and branching coral fragments. These strata are believed to have accumulated as a coral bank which was ripped occasionally by storm activity.

2. The *Amphipora* zone comprises biosparrudite in the lower part and biomicrudite in the upper part. Fragments of *Amphipora* and mat-like stromatoporoids are abundant. This zone reflects a shallowing of the water over the bank and may have resulted from upward growth of the coralline zone into a zone of greater wave activity. In Bartholomew County these strata swell to form a stromatoporoid bank with associated pelsparites and biopelsparites.

3. The *Brevispirifer gregarius* zone is characterized by mud-supported biomicrite containing *Brevispirifer gregarius* and charophyte oögonia. Corals and stromatoporoids are smaller and fewer. In Jennings County, the position of these biomicrites is occupied by laminated and mud-cracked dolomites. These strata were deposited in water that was shallow enough to sustain the sessile algae and periodically expose the laminated beds.

4. The fenestrate bryozoan-brachiopod zone is composed of grain-supported biomicrite which intertongues northward in Jennings County with laminated dolomite beds. This zone contains fenestrate bryozoan fragments, small corals, and a diverse brachiopod fauna. Although shallow waters persisted toward the north, more normal marine conditions were re-established south of Jennings County.

5. The *Paraspirifer acuminatus* zone consists mainly of grain-supported biomicrite that contains *Paraspirifer acuminatus*, fenestrate bryozoans, small corals, and abundant echinoderm debris. This widespread zone overlaps the laminated beds toward the north and reflects deepening of the waters over the entire area and return to more normal marine conditions.

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ORIGIN AND DISTRIBUTION OF GLAUCONITES AND RELATED CLAY AGGREGATES ON SEA FLOOR OFF SOUTHERN CALIFORNIA

Studies have been made of about 1,300 glauconitic samples from the sea floor off southern California, in Monterey Bay, California, and off Cedros Island, Baja California. The principal depositional environments are continental terraces, banks, ridges, and basin slopes.

Clay aggregates that probably would be designated as glauconite, according to contemporary field usage of the term by geologists, grade from relatively soft, pale yellow-green, highly expandable montmorillonitic types to dark green, illitic types. As lattice thickness [d(001)] of these different types increases, the refractive index and potassium content decreases. The organic nitrogen content is greatest in highly expandable varieties.

Glauconite may compose from less than 1 per cent to about 80 per cent of the upper few centimeters of sediment. Maximum concentrations occur in the sediments from the outer shelf and upper slope areas, but the distribution is patchy, both areally and vertically, within these sediments. Glauconite is rare in water depths of less than 100 feet. Off southern California, glauconites that probably have been deposited from turbidity currents occur in near-surface sediments from the continental rise and on the abyssal floor.

Living benthonic Foraminifera of the same species as those that are filled with expandable glauconite occur in water depths that range from approximately 100 feet to 6,000 feet. Specimens of the genus *Cassidulina* are common in Foraminiferal faunas that contain abundant glauconite-filled tests.

Glauconite replaces argillaceous sedimentary rock, mineral grains, organic carbonate, and probable fecal pellets. Some spheroidal-ellipsoidal and irregular-papillate forms appear to be of accretionary origin. The mineralogy and morphology of fillings in Foraminifera indicate that they are probably deposited by direct precipitation. Distinctive morphological varieties of glauconite are not everywhere randomly distributed, but are commonly concentrated in localized areas, which indicates that variations in morphology may be caused by local conditions of origin.

Glauconites have been recognized that are reworked from Pliocene, and perhaps Miocene, submarine outcrops. Foraminiferal tests that are filled with glauconite range in age from Pliocene to Recent and from Pleistocene to Recent. No direct evidence of present-day formation of glauconite has been found.