taining fish remains. The lower part of the Maywood formation in western Montana is 200 feet thick and may be of Early Devonian age. It is composed of thin-bedded silty dolomite and dolomitic siltstone with imbedded crystals of dolomite pseudomorphous after halite and, like the Water Canyon formation, dolomitic sandstone containing fish remains. The upper part of the Ghost River formation in west-central Alberta is lithologically similar to the lower part of the Maywood and may also be of Early Devonian age. Discontinuous shallow-water, near-shore marine deposits of these three formations were probably laid down at the mouths of bays.

The probable subsurface occurrence of the Beartooth Butte formation and its tentative correlatives provides a hitherto unrecorded and untested stratigraphic trap that might be considered in planning petroleum exploration.

Thursday Morning, April 27

Presiding: B. W. BEEBE, H. W. WOODWARD

30. Upper Cretaceous Delta on Tectonic Foreland, Northern Colorado and Southern Wyoming: ROBERT J. WEIMER, Colorado School of Mines, Golden, Colorado

Recent stratigraphic studies of Upper Cretaceous rocks in southern Wyoming and northern Colorado indicate that a large delta formed along the west margin of the seaway during the Campanian. The delta was deposited on what is now regarded as the tectonic foreland of the Cretaceous geosyncline. The axis of the delta (area of thickest non-marine and transitional deposits) extends from central Moffatt County, Colorado, in a northeast direction passing near Rawlins, Wyoming. The delta is 80–120 miles wide and was built seaward for distances ranging from 100 to 250 miles. Thus, the size of the delta is comparable with the present Mississippi River delta. The deltaic deposits range in thickness from 1,500 to 3,000 feet.

Much of the delta has been removed by erosion but parts are now found in 7 separate structural basins. Formations comprising the delta are as follows: (1) Iles and lower Williams Fork in Sand Wash basin; (2) lower part of Mesaverde in Piceance basin; (3) upper sandstones of Pierre in North Park-Middle Park basin; (4) Mesaverde in Hanna-Laramie basin; (5) Parkman and Teapot in southern Powder River basin; (6) Mesaverde in southeast Wind River basin; (7) Mesaverde (Rock Springs, Ericson, and lower Almond) in Washakie-Great Divide basin.

There are several reasons for believing that these formations are part of a single delta. Facies trends that can be traced from basin to basin show a large bulge of non-marine beds protruding into the marine basin. A complex association of intertonguing non-marine and marine sediments is present. Shoreline sand trends exhibit rapid changes from one time stratigraphic unit to another. Isopach maps show that the time-stratigraphic unit containing the delta deposits is thicker in the area of the delta than elsewhere along the coast line or in the marine basin. All formations were deposited in a dominantly reducing environment.

The delta theory explains the following anomalous stratigraphic conditions: (1) the northeast shoreline sand trends across the southern Piceance basin which are an exception to the overall north-south trends in the Cretaceous basin of deposition, (2) the marine embayment, west of the delta, in which the Ericson sandstone and associated marine beds were deposited (area of Washakie-Great Divide basin), and (3) the thin nature of the Mesaverde in the Lost Soldier area resulting from the intertonguing of the Mesaverde formation in the southeast with the marine Cody shale in the northwest.

Most of the important gas production from this stratigraphic interval in the area of discussion is associated with the shoreline zone surrounding this delta. Oil production has not been found associated with the deltaic deposits. Oil from the upper Almond in Sweetwater County, Wyoming, is largely from shoreline sandstones deposited along the west margin of the marine embayment that formed immediately after deposition of the delta.

31. Canadian Rockies: Orientation in Time and Space: ERNEST W. SHAW, Imperial Oil Limited, Calgary, Alberta, Canada

The Canadian Rockies are located between the Rocky Mountain trench on the west and the edge of the disturbed belt on the east; toward the north, they plunge out near the Yukon-British Columbia boundary and, toward the south, they extend approximately halfway through Montana. Structurally, and thus scenically, they are unique as compared with the Mackenzie Mountains on the north and the Central and Southern Rockies on the south; this striking difference is principally due to an origin of extreme shortening by means of a series of flat, superimposed thrust faults as opposed to an origin predominated by vertical uplifts in the Central and Southern Rockies.

The age of the Rocky Mountains has been determined as principally Eocene on the basis of very extensive studies of the derived sediments. By comparison, the age of the plutonization of the Western Cordillera is principally Jurassic-Cretaceous transition on the basis of recorded geological relationships or 100 ± 10 m.y. on the basis of extensive radioactive dating.

The Rockies are made up of shelf sediments aggregating 20,000 feet at their eastern edge; by contrast, the Western Cordillera is typified by extensive plutonization of the thick sediments and volcanics of a eugeosyncline.

Shortening in the sediments across the southern part of the Canadian Rockies is somewhere between 100 and 200 miles which has been accomplished by stacking of sediments on a rather uniform system of superimposed thrust faults but without disrupting the underlying shield to any known extent. The restoration of these sediments to their pre-Laramide position implies that the adjacent plutonized complex of the Western Cordillera must also be restored a somewhat similar distance toward the west. Such a restoration sets back the indented western continental margin of Canada and the Alaska panhandle, and puts it into alignment with the western continental margin of the United States. The realization of such differential movement along the western continental margin of North America in the Tertiary and the attendant tensional junctions explains many anomalous conditions in the northwestern states and southern Alaska. The cause of such differential movement in the Tertiary is much more speculative. An acceptable explanation appears to be that the rigid, simatic Pacific plate has underthrust the continental margin of the United States whereas it has pushed the continental margin of Canada ahead of it.

32. Tectonics of Northern Cordillera in Canada: L. J. MARTIN, Consultant, Calgary, Alberta, Canada

Mountains in the Yukon and Northwest Territories within the belt east of the Rocky Mountain trench are principally the product of the Laramide orogeny, but earlier orogenic periods have contributed materially to the structure in a number of areas. Evidence indicating