alteration, and have caused the permeability here to be reduced as compared with the opposite flank. 3. The presence of a much higher hydrostatic head on the mountainward or southwest flank as compared with its valleyward counterpart has also been offered as an explanation. In this connection, it has been argued that the difference in specific gravity of the oil and water is not sufficient, with a 600-foot hydrostatic head, to overcome the obstacles of surface tension, friction, and cementation on the high side of the water table. 4. Capillary-gravity action has also been considered a factor. 5. Finally, it has been suggested that the northeast flank had a much greater drainage area from which to draw its oil supply than did the southwest flank.

The fact that the anticline is *en échelon* with the adjoining structures at both ends, suggests that the forces causing this condition may have had a longitudinal component that could have tilted the north dome structure northward. Other structural and stratigraphic conditions in the field which might bear on the problem of an inclined water table are discussed; and questions are raised as to how much the genesis and migration of petroleum might be involved in a possible solution of the problem.

JUDSON L. ANDERSON, Petroleum Geology of Colombia, South America

As a petroleum producing country, Colombia ranked 8th in world production in 1940. Of the South American countries, Colombia is second to Venezuela, whose output is nearly ten times as great, and slightly ahead of Argentina. At least six petroliferous provinces may be recognized in Colombia. They are the Magdalena Valley, the southwestern basin area of Lake Maracaibo, the plains or "llanos" area in the southeastern part of the country, the coastal area of the Caribbean, the Goajira Peninsula and the Pacific coast region. The most important producing areas at present are the middle Magdalena Valley and the southwestern Lake Maracaibo area. Travel in the country is difficult except in the uplands where most of the roads are located. The native language is Spanish, English being spoken only sparingly.

Pre-Cretaceous rocks are known to occur in the Cordilleras Oriental and Central and also in the Llanos area, but are of no importance in the production of petroleum. Cretaceous limestones and shales are extensively developed east of the Central Cordillera and are highly petroliferous. Cenozoic deposits are found in the intermontane valleys, in the Llanos area and along the Caribbean coast. In the middle Magdalena Valley, there are important reservoir beds of petroleum.

Large overthrusts are characteristic features of the Magdalena Valley. They are also known to occur in the Llanos area in the valley west of the Cordillera Central and in the southwestern Lake Maracaibo basin area. In the Magdalena Valley and in the southwestern Lake Maracaibo area petroleum occurs on faulted anticlines. In the coastal region sharp anticlines, with some faulting, are known. Oil and gas seepages and mud volcanoes are of common occurrence. Little is known of the structure of the Goajira Peninsula and the Pacific Coast areas.

Production comes from Oligocene and Eocene sands in the middle Magdalena Valley. Two structures, Infantas and La Cira, produced all the oil of this region up to about 1943. Two new fields have been added to the above producers. The Barco area, located in the southwestern Lake Maracaibo basin, obtains its oil from the Cretaceous and Tertiary on faulted anticlines. In the Cesar Valley, located in the lower Magdalena Valley area, production of high gravity oil from Oligocene limestone has been reported in new wells.

BEN M. PAGE, Some California Tar Sand Deposits

The United States Geological Survey is mapping some of the California tar sand deposits that may be suitable for large-scale surface mining. It is contemplated that in some cases the bitumen may be removed and treated to yield fuel oil or other products. This paper, however, does not attempt to appraise the economic possibilities of the deposits.

In the several areas mapped to date, the Monterey shale (Miocene) is present and is considered the source of hydrocarbons.

In the McKittrick district bituminous sandstones occur in the lower part of the Tulare formation (Pliocene and Pleistocene (?)). This formation also contains small asphaltite veins. The Tulare is strongly deformed in a broken anticlinorium with a core of Monterey shale. Asphalt oozes from the Monterey and also from tar sands of the Tulare. Some adjacent alluvium is also soaked with tar.

Near Maricopa there are three areas in which asphalt issues from the vicinity of an inclined unconformity between Monterey shale and overlying beds of either the San Joaquin or Tulare formation. Adjacent sandstone and alluvium have locally been impregnated with bitumen.

In the Edna region the Monterey is overlain by shale, sandstone, and conglomerate of the Pismo formation (Miocene-Pliocene). Large, irregular masses of the sandstone are bituminous. They occur on both limbs of a broad syncline which shows subsidiary folds. Some of the asphaltic sandstones have gentle dips, are readily accessible, and have very little overburden.

The Santa Cruz bituminous sandstones are nearly horizontal and are found within and beneath the Monterey shale. Some of the rich sandstones are undisturbed beds, but others are clastic dikes.

At Point Arena, tar sands occur interbedded with Monterey shale and shaly sandstone. The bituminous beds are involved in a syncline and dip rather steeply.

John Eliot Allen and Ewart M. Baldwin, Geology and Coal Resources of the Coos Bay Quadrangle, Oregon

The Coos Bay coal field is situated on the coast of southwest Oregon, readily accessible to railroad and to the harbor of Coos Bay. It lies within a roughly elliptical structural basin measuring 35 miles north and south by 11 miles east and west.

Mesozoic sediments, schists, and volcanics, tentatively correlated with the Franciscan-Knoxville group of California, are exposed in the southern part of the quadrangle and are overlain unconformably by the middle Eocene Umpqua formation, consisting of more than 1,800 feet of tuffaceous sandstone and shale with thick lenticular basalts and pyroclastics. The Tyee massive feldspathic sandstone, about 2,000 feet thick, overlies the Umpqua and occupies the northeastern corner of the quadrangle.

About 6,000 feet of upper Eocene Coaledo sediments are confined to a complex structural basin occupying the central portion of the quadrangle. The lower and upper Coaledo members consist of medium-bedded tuffaceous sandstones made up largely of basaltic glass, separated by the middle Coaledo member consisting of 400 to 2,300 feet of dark tuffaceous shale of more acidic composition. The principal coal beds occur in the upper and lower sandstone members of the Coaledo formation.

The Bastendorf shale and Tunnel Point sandstone represent the transitional and Oligocene strata, and their outcrops appear mainly on the western edge of the basin, although the Bastendorf is also found in remnants farther eastward. The Bastendorf is 2,900 feet thick, composed predominantly of basaltic glass, and the Tunnel Point with a minimum thickness of 850 feet is composed of basaltic with less amounts of andesitic glass.

The Coaledo and the later Oligocene formations in the major basin were compressed during the Miocene into north-trending folds, and faulted by major north-trending faults and by more numerous transverse faults. The Pliocene Empire formation, comprising at