

Finding oil takes geologic luck, high technology

Finding oil takes luck and technology.

But oil itself is a result of the geologic circumstances which must follow in a particular progression to create oil in the first place, and then trap it for hundreds of millions of years.

At Prudhoe Bay, for example, some 22 billion barrels of oil are trapped in what geologists have labeled the Sadlerochit Formation. Named for a section of the Brooks Range where the same

rock layer reaches the surface, this formation of sand and gravel was deposited by an ancient braided river about 220 million years ago.

Alaska's climate was tropical then, and Prudhoe Bay oil being produced today originated as trees and lush vegetation. As successions of forests grew and died, the remains were buried by sediments such as sand and mud, carried along by rivers and deposited off the prehistoric shore.

When Prudhoe's oil was still

organic debris it was being deposited in a sedimentary basin, a sea floor that is now a layer of rock some 9,000 feet below the North Slope. Time, heat and the pressure generated by the weight of thousands of feet of rock and other sedimentary formations turned the organic matter into oil.

But the reason there is oil in the Sadlerochit Formation now is that layers of impermeable rock sandwich the 840-foot-thick for-

mation that holds Prudhoe's oil and natural gas into a trap. Contrary to some popular misconceptions, there is no underground lake of oil. Instead, the oil is trapped in the minute spaces between grains of rock in much the same way a sponge holds water.

The same pressure that helps create the oil would push it away and spread it out in layers so thin that it could not be recovered if it were not for the cap rock that

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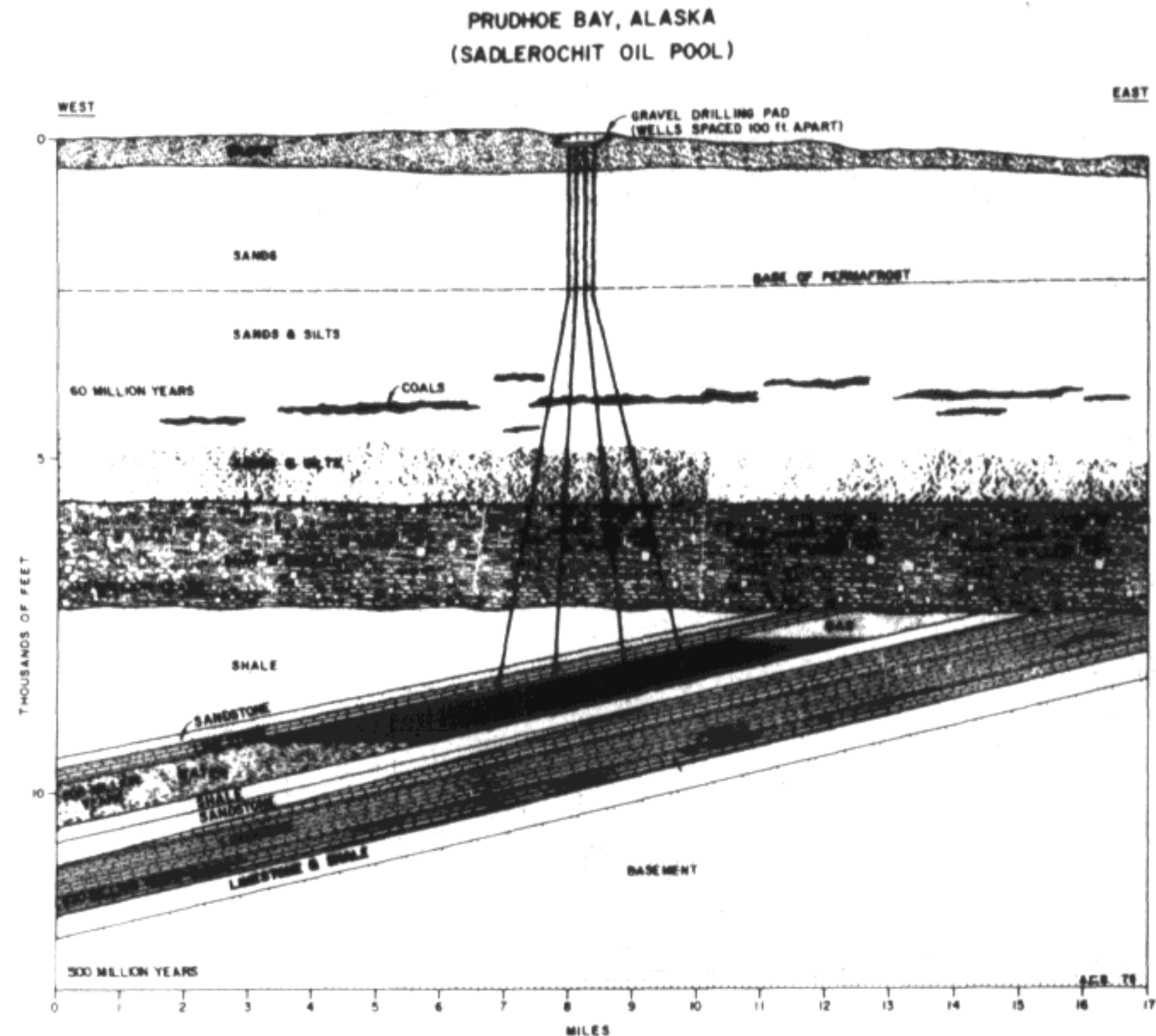
Rock layers produce and trap oil

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contains it and keeps it from moving. In the case of Prudhoe Bay, the cap rock is an impermeable layer of shale that geologists say is about 100 million years old.

Even though the Prudhoe Bay oilfield covers about 200 square miles and the oil producing zone is some 400 feet in thickness, geologists say only about 9.3 of the field's 22 billion barrels of oil will be recovered with present production techniques. For the adjoining Kuparuk oilfield, which covers more than twice the surface area, the numbers are even smaller. The producing zone is only 40 to 50 feet thick and operating companies only expect to recover about one billion barrels of oil from an estimated four to five billion that are contained in the fine grained sandstone that holds the oil.

The same geologic forces which produce the layers of rock which might contain oil also affect the rocks themselves. The weight of sediments on a weak or thin layer of underlying rock can cause that layer to bend, creating a basin.



Other types of oil trapping formations exist, but all are associated with sedimentary basins.

Although such basins may cover hundreds or even thousands of square miles, often there are only

relatively small fields of oil or gas. This is usually the case in the Lower 48. But sometimes the basins are empty and devoid of any oil or gas.

Still, petroleum geologists and

exploration specialists are able to locate likely areas with oil and gas potential. But drilling exploratory wells has proven to be the only certain method for determining the existence of hydrocarbons.