would be the deepest samples from within the moon yet to be brought back. They could extend all the way through the regolith to the bedrock.

Worden, in orbit around the moon, was also wiping out theories by his observations of some 14 areas. A particularly surprising observation was cinder cones in the area around Littrow (a crater in an area thought to be the youngest mare area on the moon). He said, ". . . in the area where we noticed darker deposits, there are a whole series of small, almost irregular shaped cones. . . . It looks like a whole field of small cinder cones." If photographs bear out his visual observations, scientists say that the presence of these volcanic remnants in one of the youngest areas of the moon would extend the period during which the moon was hot by one billion years. Originally scientists thought this period lasted only from 4.6 billion to 3 billion years ago. But the new finding would mean that it extended to 2 billion years ago.

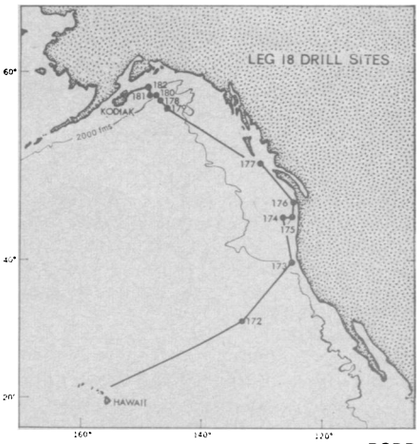
Another interesting observation Worden made was of layering in the central peak which protrudes up from the center of the crater Tsiolkovsky on the far side of the moon. This means that the peak was formed by pushing up from a depth rather than by piling up on the outside. The instruments operated in orbit are already giving scientists the mineral composition of 20 percent of the moon's surface and constituents found in the trace atmosphere around the moon.

Seismic data obtained from impacting of the Saturn 4-B stage and the ascent stage of the lunar module support theories that the structure of the moon is hard, brittle and crystalline, to a depth of 300 to 400 kilometers. Dr. Gary Latham of the Lamont-Doherty Geological Observatory had said, "If we see seismic waves 1,100 kilometers to the south at the Apollo 12 and 14 sites as well as from the Apollo 15 station, then our theory that the structure 300 to 400 kilometers deep is hard, brittle, crystalline material in which seismic waves would propagate well, is true." All three stations reported the signal.

Minor problems plagued the men, putting them behind schedule almost every mile of the way—from having to mop up 25 pounds of water to having to use tape to repair some of their equipment. But if all continued to proceed without major problems, the crew was expected to splashdown at 4:46 p.m., EDT, Aug. 7, setting in all accounts a new moon record and bringing back 175 to 180 net pounds of lunar rock and soil. Worden summed up the week pretty well: "I think we're going to give lots of people lots of things to do for a long time." □

DEEP-SEA DRILLING

Where plate meets plate



DSDP

Leg 18: Drilling crustal borders.

At deep-sea trenches, where one crustal plate is being jammed underneath another, geophysicists believe that sediments that have accumulated on the underthrusting oceanic basin are scraped off and pile up against the edge of the overriding plate. The exact nature of this sedimentary deformation, however, has not been observed in active trenches. Up to now oceanographic instruments have been unable to show clearly the complex folded and faulted structures thought to be present.

Now scientists on Leg 18 of the Deep Sea Drilling Project, which ended July 19 at Kodiak, Alaska, have recovered cores showing sedimentary deformation from several sites along the Aleutian trench off Alaska, where oceanic crust is being thrust under the continent at a rate of more than two inches per year. At one site, number 180, the researchers, led by Drs. LaVerne D. Kulm of Oregon State University and Roland von Huene of the U.S. Geological Survey's Office of Marine Geology, drilled directly along the axis of the trench. A more productive site, however, was site 181 on the landward wall of the trench, where they drilled to a depth of 369 meters. The sediment layers there, says Dr. Kulm, appear to be quite jumbled up. The top 100 meters of the core were composed of softer sediments. Below were hard mudstones, with thin, highly deformed laminations.

At another site, off California's Cape Mendocino, the researchers recovered a spectacularly complete sedimentary record spanning the past 26 million years. Fossilized microscopic marine organisms in the core, such as diatoms and radiolaria, record periods of oceanic upwelling and of varying biological productivity. Evidence from marine-plant fossils in the sediments of the coastal mountain ranges of California and Oregon has offered a much less complete record than that now obtained by the scientists on the Glomar Challenger.

The character and type of marine organisms living in the surface waters of the oceans is highly sensitive to the temperature of these waters. Fossil remains from sediments thus give an indication of ocean surface temperatures—and therefore climate—that existed at the time the organisms were alive. The Leg 18 scientists found evidence in the sedimentary record of the climatic oscillations over the past 2 million years.

Over the years, the Columbia River, which divides Oregon and Washington, has washed tons of continental materials from the land and deposited them in the Pacific Ocean. In this way, an extensive fan-shaped sediment deposit, called the Astoria Fan, has developed at the foot of the continental slope off Oregon and Washington. Spores and pollen from trees, shrubs and grasses that are entombed in these sediments carry a record of land temperatures. Cores recovered from the Astoria Fan by the Deep Sea Drilling Project researchers show that the Pacific Northwest, over the past 2 million years, has never been warmer than it is now.

Evidence from the Astoria Fan also shows that during the ice ages, sediments were carried downriver much more rapidly than the average rate at which sediments are being deposited in the deep ocean today. The high rates of sediment accumulation, the scientists believe, indicate that glacial erosion of the continents was more vigorous than previously thought.

The Leg 18 scientists drilled at a total of 11 sites along the continental margin between Oregon and Alaska. By delineating geological structures at plate borders they hope to determine the rate and direction of large shifts in the earth's crust. The 56-day cruise began May 28 at Honolulu. □

ENERGY INDUSTRIES

Making synthetic fuel gas

Critics of the United States energy industry often allege that shortages of fuels and power result from increasing monopolistic control of the industry and influence over the policies of the Interior Department. In a press conference this week, Interior Secretary Rogers C. B. Morton denied some of these allegations. He may be correct, but it is hard for the public to judge since the companies are often as secretive about their activities as Balkan diplomats.

Whichever side may be correct, Morton this week signed a contract that appears, at least, to indicate that energy