An earth twin for a rock from the moon

Some geologists hope to unravel the earth's early history by exploration of the moon, where the record has not been so obliterated by subsequent events. Although the moon rocks returned so far are composed of the same common elements as are earth rocks, there are essential differences in the abundance ratios of the elements, the amount of volatiles they contain and their oxidation states.

One example is the anorthosites. Anorthosites are plutonic rocks made up primarily of plagioclase, a common mineral composed of the aluminum silicates of potassium, sodium and calcium. On earth most of the plagioclase is rich in sodium; the plagioclase in the anorthosite returned from the moon by Apollo 15 (dubbed the Genesis Rock) is rich in calcium.

But now an earth twin to the lunar rock has been found. Last week at the annual meeting of the Geological Society of America, J. V. Smith of the University of Chicago presented the results of analyses he and F. B. Windley of the University of Leicester, England, have conducted on rocks from the anorthosite complex called Fistenaesset in West Greenland. These rocks, unlike most earth anorthosites, have the same high-calcium, low-potassium and low-sodium content as has the lunar anorthosite.

"At this point in the investigation," says Smith, "one can't tell the lunar plagioclase from the terrestrial plagioclase.

"We are puzzled about these rocks," says Smith. "Where did they come from?" The typical rock found in that area of Greenland is granitic gneiss and greenstone with high-sodium and high-potassium contents and much less calcium. Smith speculates that similar anorthosites will be found in the middle of other major land masses on earth. (In December he and Windley will begin analyses of rocks from Limpopo in Central Africa.)

The origin of anorthosites puzzles geologists because the melting temperature of anorthosites is some 200 to 300 degrees C. higher than the melting temperature of other igneous rocks. They have theorized that during the early history of the moon, for example, the outer shell melted while the interior was still relatively cool. Through some process, the plagioclase crystals separated from a melt in which several minerals were crystallizing. This anorthositic material solidified to become the lunar crust. (Recent orbital data from Apollo 15 show areas of high aluminum-to-silicon ratios, indicating the existence of plagioclase in many areas of the far side and several areas of the near side.)

"If we could find on earth evidence of similar processes as we believed may have occurred on the moon," says W. C. Phinney of the Manned Spacecraft Center in Houston, "we would have an important key to understanding the accretional history and the initial crustal formations of the planets."

For this reason scientists want to get an age dating on the Greenland material. (The lunar anorthosite has an age of about 4.1 billion years.) Material as old as 3 billion years has been found in Greenland, and American scientists are eagerly awaiting more information about a report that Stephen Moorbath of Oxford University has determined that some material from an area in Greenland about 430 kilometers from the anorthosite complex is 4 billion years old. □

Will the continents quit drifting in a billion years?

Continental drift, caused by the movement of crustal plates across the surface of the earth, has apparently been going on throughout geological time. But according to two Stanford University scientists, continental drift must eventually cease.

W. R. Dickinson and W. C. Luth believe that plate tectonics, by which crustal plates grow at mid-ocean ridges and sink back into the earth's mantle at trenches, is a one-way, irreversible process. They propose, in the Oct. 22 SCIENCE, that when plates of lithosphere descend at trenches, they sink through the upper mantle alyer, the asthenosphere, and accumulate on top of a growing inner layer, which they call the mesosphere. The descending lithosphere displaces asthenospheric material, forcing it upward to form new crust. Thus a mesosphere composed of "used" lithosphere is built up at the expense of the asthenosphere. When the asthenosphere is depleted, the scientists predict, continental drift will end. They estimate that this will occur within a billion years.

An important clue to development of their theory was the pattern of seismicity at trenches. The positions of descending slabs of crust are characterized by inclined planes of seismicity, and the depth of the deepest earthquakes is presumed to mark the lower edge of the plate. Where the leading edge of a plate has reached a depth of between 500 and 700 kilometers, the stresses in the plate are compressional, as if the lower end of the slab had hit a hard bottom. This hard bottom, say Dickinson and Luth, is the top of the mesosphere, which they estimate currently lies at a depth of about 650 kilometers.

According to their theory, the rate at which the mesosphere grows depends on the rate at which lithospheric plates are produced and consumed. It is known that about 30 percent of the earth's surface has been formed in the last 75 million years, so to test their theory the researchers estimated the rates of mass transfer involved. They conclude that the current mass of the mesosphere could have been produced in a geologically reasonable period of time. The process would have begun about 4.5 billion years ago, near the time when the earth is believed to have been formed. □

New local galaxy

A dwarf spheroidal galaxy that is a possible new member of the local group of galaxies has been found on a photograph of the Andromeda nebula taken with the 48-inch Schmidt camera on Palomar Mountain. The report, by Sidney van den Bergh of the University of Toronto's David Dunlop Observatory, appears in International Astronomical Union circular 2366 dated Nov. 1.

The new object, which has a very low surface brightness, is located at right ascension 0 hour 43.0 minutes and declination plus 37 degrees 44 minutes. Its reality is confirmed by a second photograph that had been previously obtained by R. Racine. If the new galaxy is at about the same distance as the Andromeda nebula (2 million light-years), its diameter is about 1,600 light-years). Calculated from the observed brightness and the distance, its absolute magnitude is approximately minus 11. □

House cancer bill

The House Interstate and Foreign Commerce Committee last week reported out favorably by a 26-2 vote the House version of the bill to expand cancer research. Passage of the bill, whose chief sponsor is Rep. Paul Rogers (D-Fla.), paves the way for a House vote later this month and, if passed there, a battle between House-Senate conferees who would attempt to shape a compromise. The Senate version, backed by the White House and passed 79-1 last spring, would set up a largely independent cancer agency within the National Institutes of Health; critics fear it would undermine NIH and needlessly fragment its research efforts. The House version would expand NIH's present National Cancer Institute but retain its administrative and functional ties to NIH; critics say it would maintain bureaucratic channels they contend have held back cancer research. □