OCEAN FLOOR

Standard Section

from our Geomagnetism Correspondent

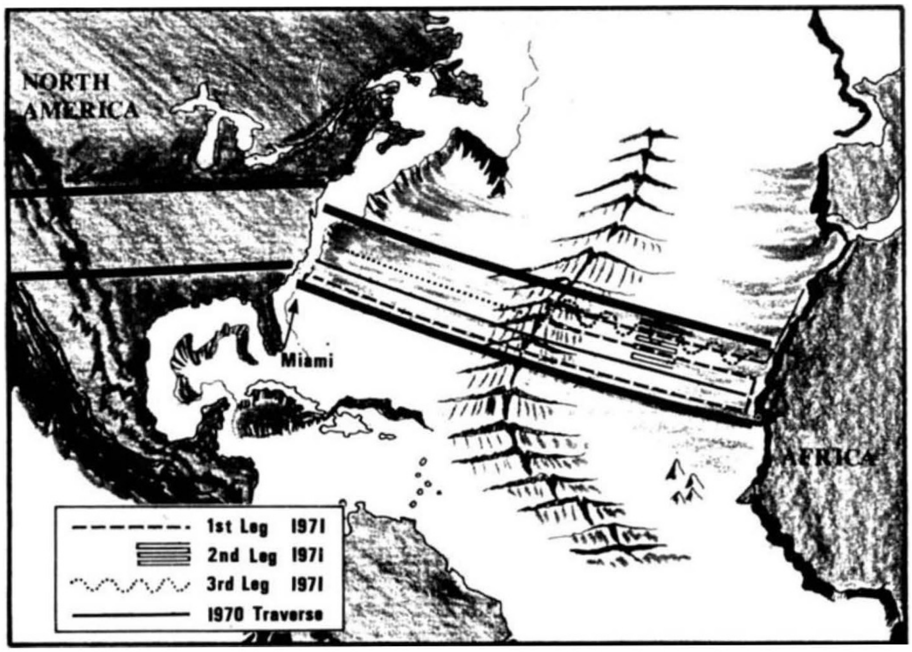
ALTHOUGH the third leg of the Trans-Atlantic Geotraverse was completed less than three months ago, some of the preliminary results have already been released by Dr Peter A. Rona, the project's chief scientist. The Trans-Atlantic Geotraverse (or TAG, in the inevitable mnemonic) was recommended in 1968 by the US National Academy of Sciences and the US Upper Mantle Committee as a desirable contribution to the International Decade of Ocean Exploration. Since it began in 1970 it has been under the direction of the National Oceanic and Atmospheric Administration which has put its own ship, the Discoverer, at the disposal of the project. According to Rona the general aim of the programme is to establish the "first standard crustal section across an ocean basin" and it certainly looks as though that will be achieved before the project is completed in 1974.

The section in question (see diagram) is a 200-mile wide, 3,500-mile long curved strip across the Atlantic from Cape Hatteras to Cap Blanc and is calculated to link points in Africa and North America which were immediately adjacent before the onset of continental drift. The western end of the traverse also links up with the Transcontinental Geophysical Survey section, the crustal section established across the United States in 1968 by means of topographic, gravitational, seismic, magnetic and rock-dating studies.

The first leg of TAG comprised three parallel tracks across the whole section. The second involved an intensive investigation of the foothills along the eastern slope of the mid-Atlantic Ridge; and, during the third, the ocean floor was sampled by dredge and corer from the mid-Atlantic Ridge to the African continental shelf. Although the project has an impeccable scientific basis in the academic sense (one of its listed aims is "a more thorough and valuable understanding of the past and present movements of the continents and rifting of the sea floor"), the emphasis is clearly on using the basic science as a guide to the assessment of the potential oil and mineral wealth of the deep oceans; and this is reflected in the first results to be announced.

Thus Rona reports that "extremely heavy" encrustations of manganese ore (which also contains copper, nickel and cobalt) have been found on exposed rocks in regions where Earth movements have caused fractures in the sea bed; and these deposits are believed to be thicker and more extensive than the better known manganese nodules found in other areas in recent years. Also under investigation by the TAG scientists—although no actual results have so far been given—is the relation between the rifting of a continent and the formation of heavy metals such as gold and platinum. Heavy metal ores are a feature of the Red Sea, a region thought to be in the early stages of rifting; and it is thus possible that the volcanic activity accompanying the formation of the mid-Atlantic Ridge may have left heavy metal deposits in the deep Atlantic beyond the continental shelves.

But of perhaps even greater significance are the large domes which have been found in the TAG section off north-west Africa and which resemble the oil-bearing salt domes in the Gulf of Mexico. The Atlantic domes which lie in 15,000–20,000 feet of water and some of which lie at least 800 miles off the African coast would, if their salt content is confirmed, be the first salt domes to be reported in the deep ocean and, as such, would represent the first indication of potentially significant marine oil resources beyond the continental shelves. The hypothesis which Rona and his colleagues are trying to test is that during its early development the Atlantic must have been a body of water almost completely surrounded by land and thus in which evaporation exceeded inflow. Under these conditions salinity would increase and salt would be precipitated, forming layers (and subsequently domes) into which would settle oil-forming plant and fish remains. As the Atlantic opened further, some of these deposits would be left in the deep ocean floor and not only on the continental shelf. So far, however, the validity of this hypothesis has not been confirmed.



ASTRONOMY

Universal Distance

from a Correspondent

How big is the universe? This was the theme of a conference on the galaxy and the distance scale held at the Royal Greenwich Observatory, Herstmonceux, from August 17 to 20 in honour of the Astronomer Royal, Sir Richard Woolley, who retires at the end of 1971.

The conference covered the whole range of distance determinations, from nearby stars to galaxies and quasars. Distances of galaxies are found by a series of intermediate steps involving galactic clusters, cepheid variables, ionized hydrogen regions and galaxies themselves as standard beacons; the latest results reported by Dr A. R. Sandage (Hale Observatories, Pasadena) give a Hubble time (time since the "big bang" if deceleration is neglected) of 18×10^9 years, exactly ten times the value estimated by Hubble in 1936, and a deceleration parameter $q_0=0.95\pm0.4$. This permits a universe that will either go on expanding indefinitely or fall back and oscillate, but probably excludes the steady-state theory ($q_0=-1$). The actual age of the universe then comes out to be about 13×10^9 years, which compares very favourably with the age of $(10\pm3)\times10^9$ years estimated for old stars in globular clusters on the basis of the theory of stellar evolution. The uniformity of the relationship between period, luminosity and colour of cepheid variables in different galaxies makes these estimates seem more firmly based than earlier ones.

Intermediate steps in the measuring process involve the distances of clusters and variable stars, corrections for absorption of light in interstellar space, the distance between the Earth and the