METEORITES, ATOLLS AND WHISKY

Improvements in the methods of measuring radioactive traces of elements in substances which can be hundreds of millions of years old have enabled many secrets of the remote past to be revealed. The techniques developed by nuclear scientists can also be applied to more recent times. In a symposium held in Monaco during March the discussions of radioactive dating and methods of low level counting brought references to meteorites, rocks, archaeology, coral atolls, ancient ceramics, and even whisky.

The symposium was arranged by the Agency in cooperation with the Joint Commission on Applied Radioactivity (JCAR). It was attended by nearly 200 scientists from 30 countries and three international organizations, and 65 papers were presented.

One of the ways of working out the age of minerals has been to count the marks made on crystals by natural fission of uranium and thorium isotopes. When the atoms of these elements split the fragments thrown out leave tracks on the crystalline structure of surrounding material. By counting the density of the tracks scientists can estimate how much uranium or thorium originally existed and from this they can determine the age of a specimen. It has now been discovered, and was reported by R.M. Walker (USA) that other tracks are made as a result of normal decay of the elements. Normal decay occurs as a result of an atom ejecting one of its components, known as an alpha particle. When the nucleus of the atom throws out the alpha particle the nucleus recoils in the same way as a gun firing a shot, and the recoil atom also makes marks, or nuclear tracks. As a result of this discovery it seemed possible to improve the sensitivity of dating methods by about three thousand times, and perhaps to fix the date of a specimen containing only one part of uranium in a million.

Professor W.F. Libby (USA), a Nobel Prize winner for his conception and development of radiocarbon dating, surveyed the history of the method. It is based on the continuous transformation of nitrogen in the higher atmosphere into radioactive carbon, part of which is taken up by living matter and by the oceans. Some studies made by this method have produced information about the history both of the world and its people. Hans E. Suess (USA) deduced that cold continental winters were abnormally frequent during the 24th and 26th centuries B.C., and perhaps also during the 37th century B.C. Increases in radiocarbon content noted by examining wood of known age were seen from 4000 B.C. to Roman times. The changes might have been an after effect of the ice age or a change in the earth's magnetic field; this in turn

could have influenced cosmic ray intensity in the atmosphere. There were indications that measurements of radiocarbon might provide a clue to the causes of glaciers, and might also bring about changes in knowledge of the neolithic and prehistoric eras. In more recent times, according to some speakers, the industrial revolution and nuclear testing had affected radiocarbon content in the air, the former as a result of burning fossil fuel and the latter by nuclear reactions releasing radioactive carbon.

The fact that sea levels can have varied by as much as 100 meters had been established by J. Labeyrie (France) as a result of investigating the composition of coral from a Pacific atoll and relating it to the knowledge that the minute creatures which create coral can live and accumulate certain radioisotopes only at the sea surface.

Several reports dealt with meteorites and the conclusions which had been drawn on their origin and history in space. One of the most interesting, because fragments were recovered soon after their fall by a group of French scientists, struck the earth near Saint-Severin, France in 1966. It had been possible to extract much information because some short-lived radioisotopes created by cosmic rays were still active. The Agency has had a small programme for some time to assist in rapid analysis of meteorites.

Some of the results of research with whisky may not provide good news for illegal manufacturers. According to M.S. Baxter (UK) the new techniques could not only establish a dating method for certain spirits but could also be used to detect illicit blenders and distillers. The measurements also served to give information on radioactive carbon in the atmosphere at given times, as a result of its movement through barley into whisky.

Gardeners may be surprised to learn that it takes between four and five years for leaves which fall from plants to reach the final stage of transformation to form humic acid. S. M. Nakhla (France) had made studies near Paris, and was also able to show that further decomposition processes take about 25 years.

Radiocarbon in the seas, the chronology of volcanic events, and dating of ancient ceramics were among other subjects mentioned during the symposium, the full report of which is to be published by the Agency. In summing up Professor P.E. Damon (USA) commented that "These techniques have advanced to the point of exquisite precision and delicate sensitivity".