would probably be sufficient to make diamond the thermodynamically stable form of carbon. Thus the nucleation of graphite will not occur within the bulk of the diamond since the pressure produced in an incipient nucleus will be sufficient to inhibit the transformation. There is experimental evidence that pressures of the order of 10^4 atmospheres are sufficient to inhibit the transformation of diamond to graphite even though diamond is still thermodynamically unstable[7].

These considerations no longer apply, of course, at the surface of the diamond, and graphitization would be expected to proceed inwards from the surface, as is in fact observed. Moreover, an incipient nucleus just below the surface (forming perhaps at a dislocation or other fault in the diamond) might expand suddenly and burst through the thin shell of diamond above it. This is thought to be the explanation of the raised features which have been described. They are, as it were, miniature volcanoes which have burst through the surface of the hot diamond and forced it to deform plastically.

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TYPHOON EFFECTS AT JALUIT ATOLL IN THE MARSHALL ISLANDS

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On January 7, 1958, a small, very intense typhoon passed directly over Jaluit Atoll in the Marshall Islands (5½° N., 169½° E.). The first reports thereafter indicated that the typhoon had wrought many profound changes, especially in its effects upon the morphology of several of the islets and upon the vegetation and soils. Accordingly, the Pacific Science Board of the U.S. National Academy of Sciences, acting together with the Office of Naval Research and the U.S. Trust Territory of the Pacific, sponsored the formation of a party of seven scientists to conduct a brief, but intensive, field study at Jaluit. In addition to myself, the field party included Dr. A. H. Banner, director of the Marine Biological Laboratory, University of Hawaii; Dr. F. R. Fosberg, Pacific Vegetation Project, U.S. Geological Survey; Dr. J. Linsley Gressitt, chairman, Entomology Department, Bishop Museum; Dr. Edwin D. McKee, geologist, U.S. Geological Survey; Dr. Herold J. Wiens, professor of geography, Yale University; and Mr. J. B. Mackenzie, who has been director of the Agricultural Experiment Station maintained at Jaluit by the U.S. Trust Territory of the Pacific during the past several years. It is the purpose of this article to report very briefly and in a preliminary sense on the principal findings of this field party, which studied conditions on several different islets of Jaluit during April 24–May 2.

The Typhoon

Because of the paucity of weather observations over the ocean to eastward, the storm that struck Jaluit was not known to be of typhoon intensity before it struck. It was, however, being carried as a storm that had appeared at Palmyra Island (5° 53′ N., 162° 5′ W.) and was approaching Jaluit from the east. After striking Jaluit, the storm moved on a west-north-west heading through the Marshall and Caroline Islands and into the Philippine Sea, where it died out. Among the islands seriously afflicted by the storm were Ponape, Truk, and the Hall Islands, all in the Caroline Islands. When the typhoon intensity of the storm was first established it was named 'Ophelia'; and that name will be used here.

At Jaluit, judging from eye-witness accounts and from the field evidence, 'Ophelia' produced winds with sustained speeds of at least 125 knots and brought ahead of it and with it pronounced storm tides on which large wind waves were superimposed. Strong winds came initially from the north-east quadrant, then backed through west to south. There was at least one distinct lull, indicating that the eye of the storm crossed the atoll. There was initially a series of wave surges from the east, and these inundated several of the islets along the eastern reef, in one instance to a depth of 6 ft. above the ground in a locality that is more than 8 ft. above mean sea level. These first inundations occurred between late morning and mid-afternoon (180th meridian time) and were quite promptly followed by much lesser inundations upon the islets along the western rim, the wave having been renewed within the lagoon, which is about 15 miles wide (from east to west) and 30 miles long (from north-north-west to south-south-east). Later, in the afternoon or early evening, there was further, but only partial, inundation from waves moving eastward in the lagoon and waves moving south-eastward over the ocean to the west of the atoll. By dawn on January 8 the storm had subsided and the wind had become easterly, the normal trade-wind direction.

Geomorphic Changes

The observations of McKee and Wiens in particular, but also those of the other members of the party, led to the identification of several new geomorphic features, especially on those islets that suffered major inundations. These include depositional and erosional forms.

The chief depositional forms produced by the storm were locally prominent gravel ridges upon the reef flat on the ocean side of some of the eastern islets; new or augmented beach ridges of gravel; gravel sheets, often tongue-shaped, extending across two-thirds of the islets in many places; and outwash features on the lagoon-side of the eastern islets. These lagoon-side sediments were strewn upon the reef and beyond into deeper water, as was shown by bottom samples obtained by Banner and McKee. They also may have helped form the gravel bars observed in some locations on the lagoon-side, both on the reef flat and beyond, though these bars also contain sediments derived from the floor of the open lagoon itself.

The most prominent erosion feature was the channels scoured out by the water. The best-developed ones originated at a break in the old beach ridge on the ocean-side of the eastern islets and extended several hundred yards across to the lagoon-side, where they gave rise to pronounced outwash features. Minor erosion features include plunge holes and scour pits.

Soils

On those eastern islets that were awash, the soils existing prior to the storm were either buried or scoured out over wide areas. On the islet of Mejatto, for example, more than half of the pre-existing soil now lies beneath a sheet of coral rubble that is from 5–6 in. to 2½ ft. thick. Severe scouring has sluiced off about one-fourth of the soil. The remaining 15–25 per cent is either partially eroded or else persists with little or no change, except, perhaps, in salinity.

A discovery made by McKee and Fosberg may prove to be of special interest. In a well cross-section, at a depth of about 3 ft., they found an undisturbed soil profile overlain by coral rubble to provide a disconformity that is precisely analogous to that produced by 'Ophelia'. This suggests that it might be possible to date, by the carbon-14 technique, those typhoons in past centuries that were sufficiently intense and sufficiently 'on target' to yield gravel sheets upon atolls anywhere.

Vegetation

The principal broad-scale effects of the storm upon the vegetation is well summed up by Fosberg in the introductory portion of his report (now in manuscript). His remarks should be viewed in the light of the fact that prior to the storm Jaluit was densely vegetated, since it lies in an area where the rainfall averages close to 200 in. a year.

"The effects of Typhoon 'Ophelia', even on the same vegetation type, or on the same plant, were by no means identical in all localities and parts of the atoll. In general, the islets on the eastside of the atoll suffered much more damage to their vegetation than those on north, south, and west. Also . . . narrow islets and parts of islets were far more affected than broad parts. This was well illustrated on Jaluit Islet, where the narrow parts south of Jabor were in places completely stripped of vegetation. . . .

"Many trees were uprooted. . . . Some were snapped off. Branches were broken or torn off of most of those that remained standing. Some exotic plants were killed or their above ground parts killed by salt. In places large scale burial of plants by gravel occurred. Elsewhere the soil with its vegetation was scoured away. Many tree trunks were seen in the lagoon on the shallower slopes along the east side. Masses of vegetable debris were strewn at random on the shallower slopes along the east side."

From the observations of Fosberg, Wiens and Blumenstock it is estimated that among those islets studied the greatest destruction was on Mejatto and northern Jaluit, both islets on the eastern reef, where 70–90 per cent of the trees were either completely uprooted or snapped off below the crown; while the least destruction was on western islets, where only 20–50 per cent were uprooted or snapped off. As for the comparative resistance of different tree species to the wind, Fosberg observes that *Pemphis*, *Cordia*, *Calophyllum*, *Casuarina* and *Bruguiera* "perhaps stood up best", while *Pandanus*, breadfruit and *Terminalia catappa* "perhaps fared worst".

Terrestrial Fauna

Gressitt observed that there was no evidence that the storm had eliminated any terrestrial faunal species. There were, however, pronounced effects upon populations and breeding-rates, with local extinction where vegetation was eliminated. He states: "Groups which seem to have suffered most appear to be rats, soil insects, grasshoppers, and scale insects. The birds (sea and shore birds, dove, cuckoo), lizards (geckos, skinks), brackish water shrimps, amphipods, land crabs, and spiders seem to have suffered very little. . . . *Culex* mosquitoes are breeding abundantly in cisterns which were inundated by sea water. House-flies and other filth flies are breeding abundantly, partly in privies as usual, and partly in some of the piles of accumulated decaying vegetation. Other insects found in the latter habitat, and under bark of dead trees, are breeding up large populations because of increase in their habitat as a result of the extensive killing and felling of trees and other plants. Still other insects, mainly moths and hemipterans, are breeding up large populations on new growth, apparently as a result of greater mortality among their parasites".

Submarine Features and Marine Life

Banner examined the submarine conditions within the lagoon by diving to depths of 30 ft. and more in many different places. He also examined depositional materials on newly formed bars and upon the islets, with special reference to its probable derivation. It was not possible, however, to observe the submarine features along the reef front in the surge channel zone because of heavy surf conditions.

On the bottom of the lagoon below low low-tide there was no evidence of disturbed conditions. Even delicate corals were not broken. In contrast, it seems likely that the outer reef front suffered pronounced changes, at least in some sections, because more than 75 per cent of the coral rubble forming the new ocean-side bar off Jaluit Islet is comprised of materials newly wrested from the outer reef.

The storm seems to have had no great effect upon the fish life in the lagoon. The inhabitants report better fishing since the storm than there was before; but it is possible that they gain this impression through having to fish more intensively than before, since vegetable food is in short supply.

Demography and Cultural Effects

Fourteen Marshallese died in the storm. Two more died of exhaustion immediately thereafter. This toll was surprisingly light considering the fact that there were some 1,200 inhabitants living on the atoll when the storm struck.

The low fatality-rate was the result of three factors. Imroj, the most densely populated islet, was not completely under water. Further, about 150 natives of Mejatto happened to be visiting Imroj for a social event when the storm waves swept their islet. And the natives on Jaluit Islet were able to take refuge in sturdy Japanese, cement-block buildings that were the only structures to withstand the storm.

On islets not under water, nearly all habitations were destroyed. Buildings made of board and corrugated iron blew apart. Native buildings, of grass, fibre and pandanus, blew down; but according to informants these were readily pushed back up, reinforced, and thus re-established after the storm.

Many of the inhabitants on the eastern, inundated islets have been forced to move to Imroj. Already, however, a few are beginning to move back home. Great quantities of supplementary food are being supplied by the U.S. Trust Territory Government, and these supplies will have to continue for a long time. Though replanting is taking place and though new vegetation is sprouting from vegetative debris, it will doubtless be at least a decade before the atoll has really recovered. Meanwhile, it is planned to re-study the atoll at intervals to learn how an atoll recovers from a typhoon strike.

FLUORINE COMPOUNDS

AT the recent meeting of the British Association in Glasgow, one of the sessions in Section *B* (Chemistry), on September 2, was devoted to various aspects of the chemistry of fluorine compounds. Dr. J. Craik presided during the first part of the meeting, and Prof. R. A. Raphael for the latter part.

The first paper, given by Dr. J. C. Tatlow (University of Birmingham) was entitled "Fluorocarbons: a New Branch of Organic Chemistry". As a result of investigations during the past twenty-five years, it is now apparent that there exists a new type of organic chemistry, based upon the carbon–fluorine system, and paralleling the carbon–hydrogen system of ordinary organic chemistry. Thus, analogous to the saturated hydrocarbons, there are the fluorocarbons. Many open-chain and alicyclic compounds of this type are now known, with up to thirty or more carbon atoms. Fluorine can form the basis for this new branch of organic chemistry because the bond between a carbon and a fluorine atom is an extremely stable one, and also because the size of a fluorine atom is not too great to allow saturated fluorocarbon chains [$CF_3.(CF_2)_n.CF_3$] to exist without strain. If the atoms were very much larger, there would be insufficient room for enough of them to be carried on a carbon skeleton. However, fluorine atoms are bigger than hydrogens, and in a fluorocarbon they shield the backbone of carbon atoms, and thereby protect them from attack by chemical reagents, much more effectively than is the case with hydrogen substituents in hydrocarbons. Thus, two factors contribute to the great stability of fluorocarbons which are among the most unreactive organic compounds known. They are non-inflammable and are resistant to attack by acids, alkalis, oxidizing agents, and reducing agents.

As in orthodox organic chemistry, a vast range of compounds based on this parent series is capable of existence, since various other atoms and functional groups can be substituted in the molecules. Such derivatives are rarely prepared from fluorocarbons themselves (because of the great stability mentioned above they will seldom take part in controlled reactions). However, very many classes of fluorocarbon derivatives containing a variety of functional groups can be made in other ways. Simple examples of types now freely available are fluorocarbon carboxylic acids (for example $CF_3.CO_2H$), sulphonic acids (for example, $CF_3.SO_3H$), alcohols (for example, $CF_3.CH_2OH$), and amines (for example, $CF_3.CH_2NH_2$; compounds containing the groups $-CF_2.OH$ and $-CF_2.NH_2$ are not known). In all cases a complete homologous series can be made. The fluorocarbon part of the molecule can modify considerably the properties usually conferred on an organic compound by the functional group. Thus, the acids $CF_3.CO_2H$ and $CF_3.SO_3H$ are very much stronger than their analogues containing CH_3-groups. Usually, however, the fluorocarbon residue retains its inertness to chemical attack. Hydrogen and the other halogens can accompany fluorine as substituents on a carbon skeleton, and again various functional groups can be present as well, so that vast numbers of fluorine compounds are potentially capable of existence.

Recently, routes to perfluoro-aromatic compounds such as hexafluorobenzene have been opened up, and this most interesting new section of fluorocarbon chemistry is being investigated actively at present.

Because of their general stability, organic fluorine compounds are becoming increasingly important industrially as specialist materials. One typical example is in chromium plating, where long-chain fluorocarbon sulphonic acids (for example, $C_{10}F_{21}.SO_3H$), which are surface-active, can be employed to reduce spray above the plating baths. These use hot chromic acid, which attacks and destroys hydrocarbon-based detergents.

Fluoro-polymers are finding ever increasing applications. Recently, a series of rubbers has been introduced which are very stable towards heat and chemical reagents.

Mr. H. R. Leech (Research Department, I.C.I. General Chemicals Division) spoke next on "The Industrial Advance of Fluorine". A generation ago, fluorine was an 'awkward' element. The compounds in which it occurred naturally were inert and insoluble, but when they were brought into chemical usage, great difficulty was experienced in handling hydrogen fluoride and the element itself. This situation has now been changed completely, however. It is not always realized that fluorides are quite widespread in Nature, the element being thirteenth