Geology. — *"On the occurrence of diamond as an accessory mineral in olivine and anorthite bearing bombs, occurring in basaltic lava, ejected by the volcano Gunung Ruang (Sangir-Archipelago north of Celebes)."* By Dr. W. F. GISOLF. (Communicated by Prof. EUG. DUBOIS).

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Dr. G. L. L. KEMMERLING, chief of the volcanological survey of the Dutch East Indian Archipelago, having collected some bombs out of the basaltic lavas from the volcano Gunung Ruang, composed of a mixture of a dark green to black mineral and glassy plagioclase, the latter in crystals of a size up to 1 cm., kindly intrusted those to the author for microscopical examination.

Two kinds of rock were collected; the first of these is dense and black and shows strong magnetic properties; examination with a magnifying glass reveals the presence of magnetite with a tinge of blue; under the microscope it proved to be composed of densely crowded grains of magnetite and between those one can indistinctly recognize strong pleochroitic hypersthene and green coloured monoclinic pyroxene.

The second kind, which contains much less magnetite, is composed of corroded olivine, fringed by a border of strong pleochroitic hypersthene; it also contains bottle-green monoclinic pyroxene. The plagioclase in both kinds of rock could be determined as belonging to members of the group which are very rich in anorthite.

In some of these rocks an accessory mineral occurs in a considerable number of minute grains. They may be seen most clearly in specimen 285 A in which the olivine can be recognized macroscopically; around the bomb a crust of the lava in which it is imbedded is to be seen; this lava has the composition of a basalt with bottle-green augite and very basic plagioclase.

The plagioclase is twinned according to the albite- and Carlsbad laws; one of the thin sections shows a plagioclase with three lamellae; the first shows in the conoscope, between crossed nicols, the emerging of the Z-axis within the field of view, slightly inclined to the surface of the section; the extinction amounts to 65 degrees. The second lamel shows in the conoscope the emerging of the X-axis, also slightly inclined; the extinction is 32 degrees. The extinction of the third lamel is 85 degrees. These observations unmistakable point to a plagioclase very rich in anorthite.

The hypersthene is strongly pleochroitic from pale green to brown pink and has a double refraction rather strong for an orthorombic pyroxene. The hypersthene often contains freakishly formed grains of magnetite.

The olivine, as seen under the microscope, is colourless; it has a high double refraction and is always corroded.

The above mentioned accessory mineral occurs in well-shaped colourless crystals, which are most like to octahedrons, occasionally with pyramids on the planes, forming triakisoctahedrons; the size of these crystals is minute, in most cases they are thinner than the section is, about $^1/_{70}$ mm. The slide was difficult to cut. The crystals are isotropic, they diminish the colour of polarisation of the host-crystal, but are dark with the host-crystal between crossed nicols. They show a large black border in ordinary light, also when they occur in olivine, owing to their very high refraction.

In many cases the border is so large that only a cone of light emerges at or near the centre of the grains; this cone can be followed by moving the tube up and down. The mineral in question occurs both within olivine and anorthite; in the latter it is principally deposited on the planes of zonal structure. Besides the crystals also some irregular grains occur of the same substance, showing the same properties.

The hypersthene is, remarkable enough, devoid of this mineral or contains only some occasional grains.

A fragment of the rock with a flat side was chosen; under applications of pressure striae could be obtained on topaz and on corundum. Pressure had to be applied, because in preparing the slides it became evident that the grains of the mineral were easily jerked out; consequently many cavities are to be seen in the slides.

To resume: the mineral is isotropic, has an octahedral habitus, a very high index of refraction and a hardness exceeding that of corundum, if at least we may assume that the striae on these minerals are due to the minute grains; about this however little doubt is possible. From these observations we must conclude that the mineral is diamond; no further experiment being required, which would indeed be very difficult owing to the extreme minuteness of the grains.

Assuming this to be true, it seems to me, that it throws a wonderfull happy light upon the genesis of this mineral. As everywhere else, the mother-rock has a peridotitic nature; but in this case there can be no question of layers of coal or shales, broken through by lava, fragments of which possibly could have been taken up in the lava and could be the source of the carbon in the rock.

The diamond is here a primary mineral and even older than the olivine.

The question left to be answered is this: why is the hypersthene free from grains of diamond, the olivine and anorthite containing them both? notwithstanding the fact that the hypersthene crystallized after the olivine and before the plagioclase.

The solution of this question is presumably, that the rock was originally wholly composed of olivine, and that in the cavities, formed by resorption, the anorthite crystallized; the olivine being resorbed the crystals of diamond were freed and suspended in the mother-liquor; the hypersthene has, by surface-tension, repelled these grains, which were collected in the anorthite, in which they occur as above stated, on the planes of growth or zonal structure. This being true, the reaction olivine → hypersthene + magnetite cannot have occurred in the solid phase because in that case there could have been no reason for the diamond to be driven out.