II. THE SANDS

An approximate mechanical analysis was made by sifting the samples through sieves of 90, 60, and 30 mesh. This gave four groups, viz.

(1) Grains smaller than ·2 mm.
(2) Grains between ·2 mm. and ·4 mm.
(3) Grains between ·4 mm. and ·7 mm.
(4) Grains larger than ·7 mm.

The volume of each group was measured and the sizes determined by measurement under the microscope with an eyepiece micrometer. Aggregates and concretions were ignored in making the mechanical analysis.

The grains were separated in a Sollas separating funnel, by means of bromoform (sp. gr. = 2·815), into three groups, viz.

(1) Minerals with sp. gr. > 2·815, called the heavy minerals.
(2) Minerals with sp. gr. between 2·815 and 2·60.
(3) Minerals with sp. gr. < 2·60, called the light minerals.

Salt and gypsum were detected in the cements or the fine powders by treatment with water or HCl, and allowing a drop of the solution to evaporate and deposit crystals of salt and gypsum when present. Magnetite was picked out with a bar magnet.

Some of the larger grains and pebbles were crushed in a diamond mortar and their structure and composition examined under the microscope.

Description of the Mineral Grains.

The extinction angles quoted are the maximum values observed, and when pleochroism is noted the colour of the vibration having the greater refractive index is stated first.

Amphibole is abundant in nearly all samples. The grains vary from a prismatic type, usually with broken ends, and rarely terminated by faces at one end, to almost completely rounded grains. The majority of the grains show a well-developed cleavage: such grains give in convergent light a partial negative interference figure with the plane of the optic axes slightly oblique to the cleavage cracks.

Five types can be distinguished, and are referable to:—

(1) *Tremolite.* Colourless, generally finely striated. Extinction angle 19°.

(2) *Actinolite.* Light green. Pleochroism—light bluish green > light green to light olive green. Extinction angle 19°.

(3) *Hornblende.* Dark green to blue green. Pleochroism—dark green to blue green > light green to olive green. Extinction angle 25°.

(4) *Basaltic Hornblende.* Brown. Pleochroism—dark brown > light brown. Extinction angle 10°. Less common than (1), (2), and (3).

(5) *Glaucophane.* Bluish violet. Pleochroism—blue > violet. Extinction straight. Rarely seen in three samples in rounded prismatic grains.

Types (1) and (2) are, in general, more prismatic in character and less rounded than types (3), (4), and (5).

Some grains are partly, or wholly, altered into an aggregate of fine needles with very low double refraction, apparently chlorite.

Andalusite is rare in rounded, colourless grains with irregular black inclusions. Pleochroic in patches—colourless > pink.

Apatite is common in colourless, rounded prisms and grains.

Augite is common in a number of samples in light green, more or less rounded, prismatic grains. It is not pleochroic and has a maximum extinction angle of 45° measured to the prism. Some grains give a partial positive interference figure. The cleavage is not well developed.

Biotite is abundant in a great many samples in well-rounded to subangular cleavage flakes. The double refraction is very low and the optic axial angle is variable, but generally nearly 0°. Several flakes have needle-like inclusions arranged at 60° to each other, and in one flake at 30° to each other. The 'needles' have a positive elongation, and give polarization colours of the first order grey; the extinction angle varies from 0° to 25°.