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THE GEOLOGY OF THE NORTHERN PART OF NORTH ARM MASSIF, BAY OF ISLANDS OPHIOLITE COMPLEX, NEWFOUNDLAND: WITH APPLICATION TO UPPER OCEANIC CRUST LITHOLOGY, STRUCTURE, AND GENESIS

by

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FIGURE 3.2

The Trout River Fault as it appears in the stream cut at the southeast end of the mapped section of the fault. The fault dips to the northeast, to the left in the photograph. K. Scanlon is standing on the sharp contact between foliated metamorphic aureole in the left of the photograph and harzburgite tectonites to the right. The fault zone is several meters wide and consists of sheared, serpentenized, faulted and rodingized tectonite.

FIGURE 4.3

Typical exposure of pillow lavas, showing characteristic size, circular to ellipsoidal cross sections, and fracturing patterns, including "crazed" surface fracturing. The hammer head is 17 cm long.

FIGURE 4.4

Pillow lavas overlain with basaltic breccia. The radial fracturing is common to and characteristic of pillows. A thin (less than a centimeter) chilled margin or rind may be seen on the pillow in the lower right foreground. The hammer head is 17 cm long.

FIGURE 4.5

A portion of a stream outcrop of volcanics showing massive (flow) basalt. Three separate steeply dipping flow units may be seen within the photograph. From left to right these are: a massive flow approximately 75 cm thick located to the left of the hammer, a 3 to 5 cm thick flow beneath the hammer head, and a thick unit consisting of semi-brecciated massive basalt which grades into pillowed basalts to the right of the field of view. The top of the sequence is toward the left and the flow sequence is: pillows, massive basalt partially brecciated, thin flow, thick flow. The hammer length is 37 cm.

FIGURE 4.6

A stream-washed and smoothed exposure of basaltic breccia composed of angular, unsorted fragments of vesicular basalts plus several fragments of white chert. The diameter of the hammer handle is about 3 cm.

FIGURE 4.3

FIGURE 4.4

FIGURE 4.5

FIGURE 4.6

FIGURE 4.7

Photograph of a thin section (in ordinary light) of red radiolarian chert intercalated with pillowed lavas and with thin basalt flows. Length of field of view is 3.5 cm.

FIGURE 4.10

An example of an outcrop of sheeted diabase dikes. Dikes dip to the left about 70°. Individual dikes normally cannot be distinguished at this distance from an outcrop but this outcrop contains several pinkish-tan weathering dikes which contrast with the more common grey weathering variety. Note the abrupt truncation of the dike near the butt of the hammer handle. The hammer head is 17 cm long.

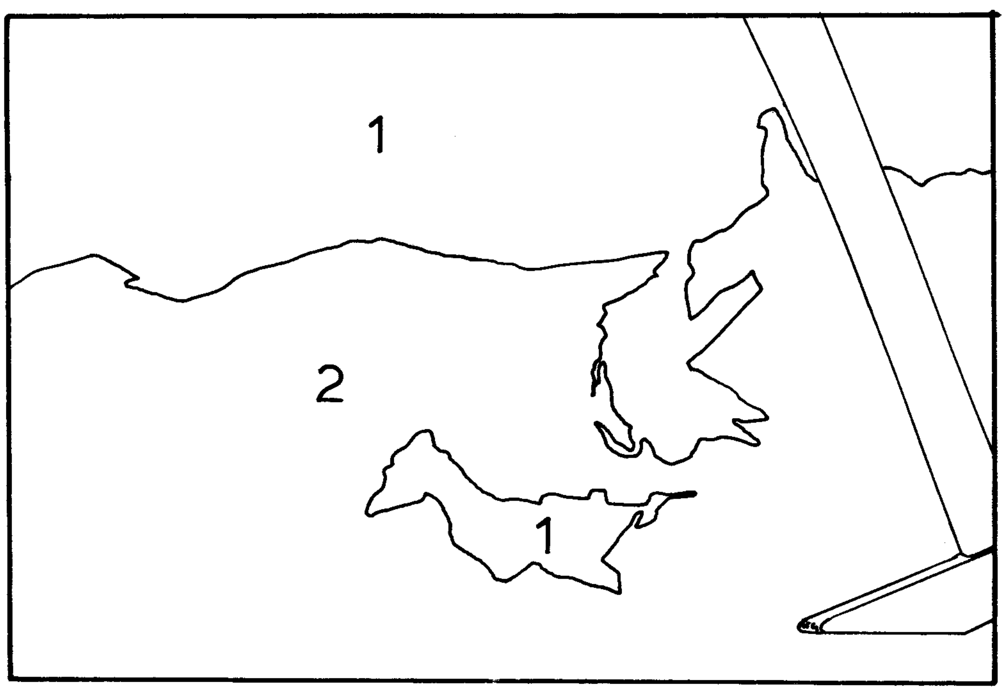

FIGURE 4.13

Detail of a dike margin within the sheeted diabase dikes, showing the common complexity of these margins, including the presence of dike apophyses. The dike designated 1 intrudes the dike designated 2. A distinct chill margin is lacking and dikes can be distinguished only by textural differences and by the character of the margin. The width of the area shown in the photograph is about 45 cm.

FIGURE 4.14

Photograph of a thin section of a contact between a medium-grained plagioclase porphyritic dike and the chilled margin of a fine-grained diabase dike which splits the porphyritic dike. Individual phenocrysts within the host dike have been truncated along the contact. The host dike shows no apparent contact alteration. Grain-size within the chilled side of the contact, aphanitic within a millimeter of the contact, increases slightly and progressively away from the contact. The faint millimeter thick banding subparallel to the contact reflects slight concentrations of plagioclase and apparently originates by magma flow. The length of the field of view is 3.5 cm.

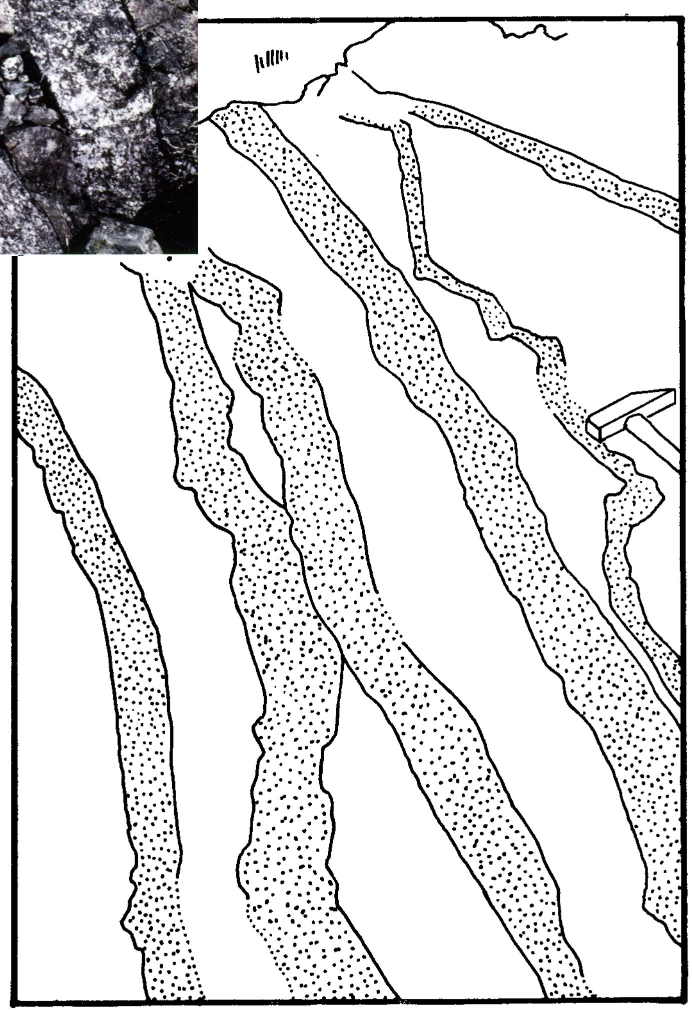

FIGURE 4.15

Diabase dikes cutting isotropic gabbro, an example of map unit DG. Note that individual dikes are relatively thin, 15 cm or less. The length of the head of the hammer is 17 cm.

FIGURE 4.17

Cut surface of a small hand-sample of massive plagioclase porphyritic diabase, showing a characteristic tecture of this rock. The sample is also cut by an irregular centimeter thick zone of quartz diorite, extending from center right to upper left across the sample.

FIGURE 4.18

A typical exposure of thin, diffuse compositional layering present in places within isotropic gabbros.

FIGURE 4.19

An example of "clotted" gabbro. The very coarse grained clot in this example is about 35 cm in diameter and contains crystals of only about 2 to 3 cm in length. Gabbro seen within the upper right corner of the photograph is of the normal grain size. The pen is 14.5 cm in length.

FIGURE 4.20

An outcrop of "mixed" gabbro and microgabbro, showing both the overall subplanar structural grain of the rock and the characteristic irregular diffuse contacts among rock of varying textures, indicative of partial resorption of country rock by subsequent intrusions. The hammer head is 17 cm long.

FIGURE 4.21

A thin, light weathering, branching ductile shear zone within isotropic gabbro, truncated by a fine-grained diabase dikelet. The length of the hammer head is 17 cm.

FIGURE 4.22

Isotropic gabbro wherein coarse-grained foliated gabbro (above) is separated from coarse-grained non-foliated gabbro (below) by a medium to fine-grained 15 cm thick ductile shear zone, itself displaced about .5 m in a right-lateral sense by later discrete faults. The foliated gabbro is clearly truncated by the shear zone. Note the thin discontinuous rind of very coarse-grained non-foliated leucogabbro along the edges of the shear zone, which suggests that shearing may have involved local partial remelting of the country rock. Pen length is 14.5 cm.

FIGURE 4.21

FIGURE 4.22

FIGURE 4.23

A typical outcropping of trondhjemite in the form of a large netted mass enclosing angular blocks of the country rock, in this case isotropic gabbro. The length of the hammer is 37 cm.

FIGURE 4.24

A single trondhjemite vein intruding coarse to medium-grained isotropic gabbros.

FIGURE 4.23

FIGURE 4.24

FIGURE 4.25

Outcrop of layered gabbroic rock within the West Block, showing characteristic layering at two scales. Layering is defined primarily by varying amounts of olivine, secondarily by changing plagioclase and clinopyroxene content. Light weathering layers consist of gabbro and leucocratic olivine gabbro, the orange-brown weathering layers of troctolite or highly mafic olivine gabbros, locally wehrlitic. Note that the thinner of the individual layers pinch out laterally; this shape is characteristic of the thicker layers also. Internal cumulate structures indicate that layers top toward the right. The length of the hammer is 37 cm.

FIGURE 4.26

Detail of gabbroic layering within the West Block, showing both the common sinuousity of layering and lateral pinching out of individual layers. Olivine weathers orange, pyroxene dark green and plagioclase white. The layer structures shown might reasonably be interpreted as a cumulate/sedimentary trough, topping toward the right.

FIGURE 4.25

FIGURE 4.26

FIGURE 4.27

The typical appearance of layered gabbroic rocks as exposed at the northeast corner of the East Block (southeast corner of Plate 1). Layering is defined by varying proportions of plagioclase (white) and pyroxene (green). Layer boundaries are usually diffuse. Individual layers pinch out laterally. The top of the layered sequence is toward the right. The white and grey irregular sploches on the rock are lichens. The length of the hammer head is 18 cm.

FIGURE 4.28

Tightly folded layered gabbroic and ultramafic rock located approximately 10 m above the base of the eastern layered gabbroic rocks. A fold hinge is located immediately above the butt of the hammer. Individual layers are composed of dunite, troctolite, wehrlite, olivine gabbro and gabbro; the orange-tan weathering layers are olivine-rich. The rock is cut by a penetrative foliation (not visible in the photograph) which is axial planar to folding and is defined by flattening of mineral grains. The length of the hammer is 37 cm.

FIGURE 4.27

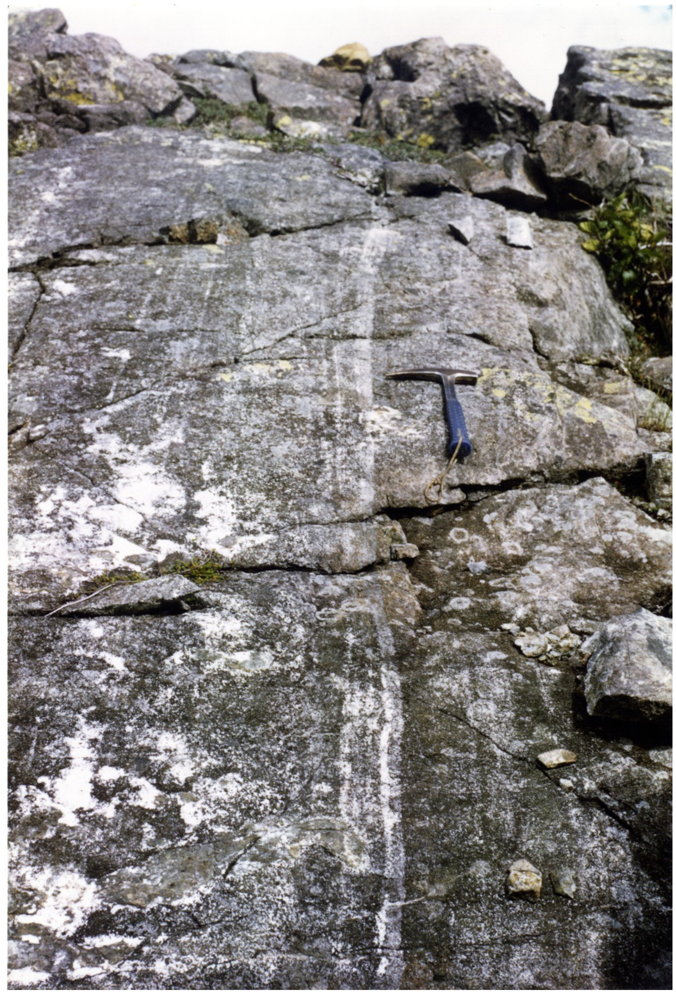

FIGURE 4.28

FIGURE 4.29

Centimeter-scale layering present within exposures of the layered ultramafic unit. The layering shown is composed of dunite (smooth gold weathering) clinopyroxenite (grey-green blocky weathering) plus the intermediate lithologies wehrlite and olivine clinopyroxenite. The clinopyroxenite layers are slightly boudinaged. The length of the hammer is 33 cm.

FIGURE 4.30

A tight, similar fold within harzburgite tectonite. Layering is defined by varying proportions of enstatite (pinkish weathering) and olivine (gold weathering). Note the thickening of layering at the fold hinge. The rock is distinctly foliated axial planar to the fold; the compass center line is oriented parallel to the trace of foliation on the outcrop surface. Foliation is defined by the preferred orientation of enstatite aggregates and by spaced surfaces of incremental displacement, both of which are visible in the photograph. The diameter of the compass is 7 cm.