GEOMORPHOLOGICAL MAP OF EAST ONGUL AND WEST ONGUL ISLANDS

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EXPLANATION

Regional setting

The Ongul Islands lie approximately 5 km west of the eastern coastline of Lützow-Holm Bay in Queen Maud Land, East Antarctica. Among the many small islands, West Ongul and East Ongul Islands are the largest, with low-lying undulating features below 48 m a.s.l. Syowa Station, the main scientific station of Japanese Antarctic Research Expeditions, is situated in the northern part of East Ongul Island. Since 1957 a number of studies have been done on the raised beach deposits and glacial landforms along the ice-free rocks of the Sôya Coast facing Lützow-Holm Bay (Yoshikawa and Toya, 1957; Fujiwara, 1973; Moriwaki, 1976; Omoto, 1977; Yoshida, 1983; Hirakawa *et al.*, 1984; Hayashi and Yoshida, 1994; Igarashi *et al.*, 1995; Maemoku *et al.*, 1997; Hirakawa and Sawagaki, 1998; Miura *et al.*, 1998a, b, c). Geologically the Lützow-Holm Bay region is part of the Lützow-Holm Complex (Shiraishi *et al.*, 1987) consisting of a diversity of rock types including: calcareous, pelitic, quartzo-feldspathic, intermediate, basic and ultrabasic rocks. The Ongul Islands are part of the granulite-facies terrain, and pyroxene gneiss is a common lithology. Garnet gneiss is dominant on East Ongul Island, while garnet-biotite gneiss and granitic gneiss are dominant on West Ongul Island. The geological (Ishikawa *et al.*, 1994) and topographic maps including submarine topography (Moriwaki, 1979; Sawagaki, 1995a) are represented as separate small-scale maps.

Construction of the geomorphological map

There are three main legend groups on the geomorphological map: 1) Morphography and morphogenesis, 2) Geomorphological processes, and 3) Individual geomorphological processes and their traces. Mapping of each feature is as accurate as possible according to the results of the field observations and aerial photographic interpretation.

1) Slopes and slope segments are depicted by concave/convex breaks of slopes and by the axes of concave/convex slopes with gray solid/broken lines. Cliffs and steps are indicated by the tooth symbol with different colors. Ridges and valleys, which are mostly controlled by geological structure, are classified into three and two types using different colors and symbols. Although some ridges and small linear valleys are of glacial origin, they are all represented as "structural" features by brown because of the difficulty of distinguishing them from structural ones. Morphometric information, such as cliff height and curvature of slope, is not given.

2) Specific geomorphological processes are indicated by areas with different colors: purple area for glacial process, green for marine process, pale-blue for fluvial and/or nival-fluvial process and yellow for eolian process. Glacial landforms are classified as either depositional or erosional, and are depicted by light and dark purple, respectively.

3) Individual geomorphological processes and their traces are illustrated by purple symbols for erratics and glacial striae, ruby symbols for some periglacial landforms, blue symbols for nival-fluvial slope wash and red symbol for active honeycomb weathering. Fossil shells and abandoned penguin rookeries are represented by green symbols. Selected radiocarbon dated ages of fossil shells are given on the map.

Characteristics of main landforms

Glacial landforms

The evidence of erratics and some glacial landforms indicates that the Ongul Islands were covered by the ice sheet. Glacial erosion by ice flow from the east scooped out shallow depressions or troughs on bedrock trending ENE-WSW. Shallow depressions and rises trending N-S were also sculptured by the ice sheet, although they show considerable rock control caused by dipping gneissic structure and different resistivities of various gneissic rocks. Submarine depressions around the Ongul Islands also are glacial troughs eroded by N-S trending ice flow. The deep Ongul Strait, between the Ongul Islands and the continent, is a N-S trending drowned glacial trough (Fujiwara, 1971). Glacial striae remaining in a few places indicate two different trends of N35°-65°E and N15°-45°E. Relatively thick till is distributed in some depressions.

Marine landforms

Marine processes are recognized only in the area where marine sediments are locally distributed. Raised beach deposits and marine mollusc fragments, however, can be found up to 20 m a.s.l. in the Ongul Islands. TAMS-radiocarbon dates of fossil marine organisms in raised beach deposits are clearly classified into two groups of ca. 3.5-4.8 ka and ca. 30-46 ka. The older fossils are found in the Ongul Islands and the northern part of Langhovde, which are separated from the present ice sheet margin by a drowned glacial trough deeper than 500 m. On the basis of these facts, in addition to the deep continental shelf and a small amount of isostatic uplift of Holocene raised beaches, Igarashi *et al.* (1995) and Miura *et al.* (1998a, b, c) reached the following conclusions: 1) Marine transgression took place during the last interstadial period (Oxygen Isotope Stage 3 ?) and the Holocene. 2) Major deglaciation took place by the last interstadial period. 3) Expansion of the ice sheet during the LGM was slight although its extent is still unknown. 4) Sea-level during the last interstadial prior to the LGM was probably higher than that estimated from foraminiferal $\delta^{18}O$ records in deep-sea sediments.

Periglacial landforms and phenomena

Tundra polygons, permafrost active-layer collapse and occurrence of periglacial creep/gelifluction are restricted in unconsolidated materials with sufficient soil water, such as marine sediments and glacial tills. Measurement of ground temperature and frost heave near Lake Midori during 1992-1994 (Sawagaki, 1995b) revealed: 1) maximum thickness of the active layer of permafrost was 60-80 cm, 2) isotherm lines of 0°C suggested that seasonal freezing during late summer had occurred both downward from the ground surface and upward from the permafrost table, 3) frequent diurnal frost heaves were caused by freeze-thaw cycles above 10 cm depth, and 4) seasonal frost heave was 3 mm. Frost shattering occurs frequently in restricted locations where meltwater from drift snow runs during the austral summer.

Nival-fluvial are surface wash and rill erosion processes operating around the drift snow. The niveo-eolian process takes place in localities where eolian sand on the drift snow is released and deposited during the thawing season.

Submarine topography

N-S trending troughs and E-W trending basin-and-sill topography are remarkable in the submarine topography around East Ongul and West Ongul Islands. These directions seem to be concordant with geological structures such as the strike of foliation and the joint system of gneissic basement rocks as inferred from the geology of adjacent ice-free land areas. Stoss-and-lee topography is also present on the sea floor. These submarine features are apparently drowned glacial landforms. There is a break of slope between the submarine and subaerial topographies on East Ongul and West Ongul Islands. The slope above sea level is gentle while the slope under water is steep. Such a break is not as conspicuous on adjacent small islands where a flat area is narrow or absent (Moriwaki, 1979).

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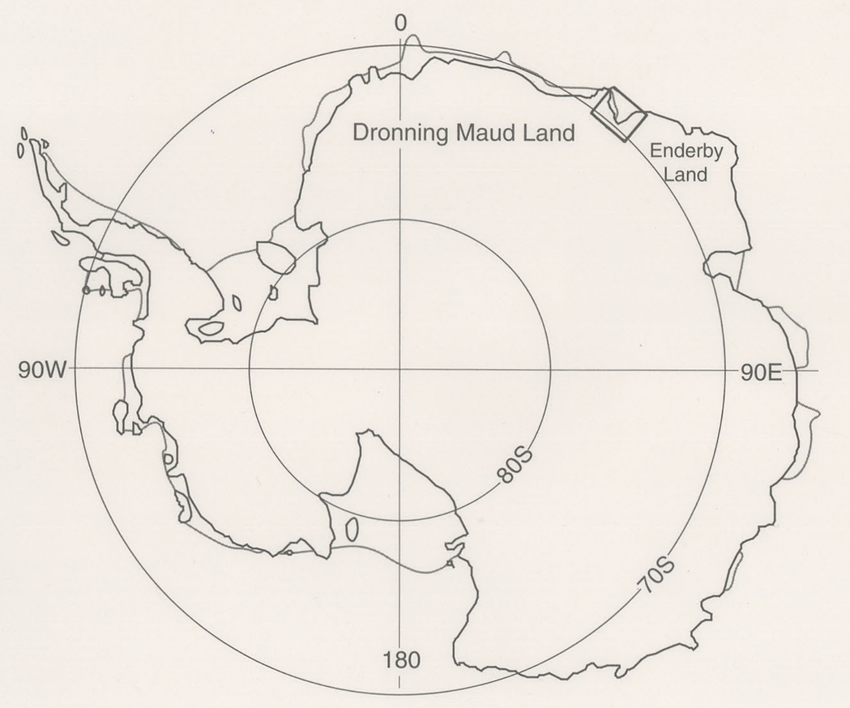
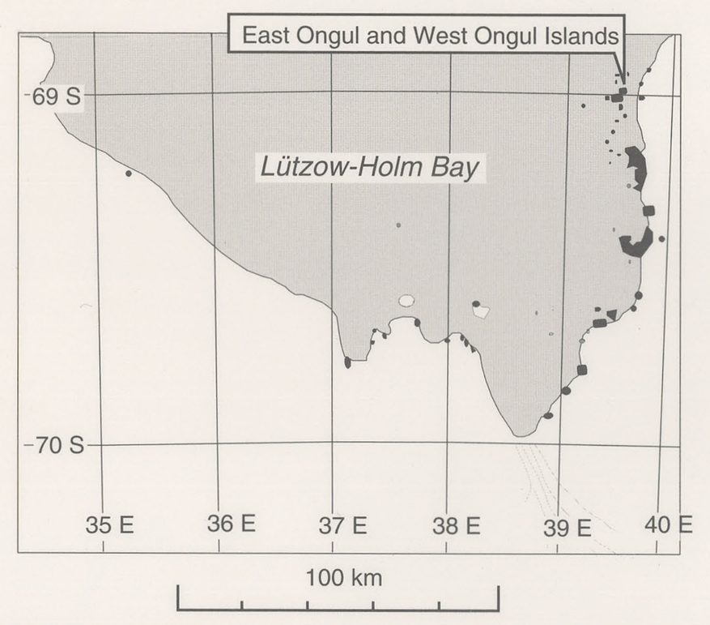




Base Map: Topographic map of Ongul Island, 1:10,000, published by National Institute of Polar Research, 1993

1:10,000

メルカトール図法(Lat69°01′)

凡例 LEGEND

1．地形形態的要素 Morphography and Morphogenesis

1）傾斜変換線 Axes of curved slope segments, break of slopes

- 凸型傾斜変換線 Axes of convex slope, sharp convex break
- 凹型傾斜変換線 Axes of concave slope, sharp concave break

2）崖 Steps and Cliffs

- 地質および岩石構造制約による崖 Cliffs controlled by geology and lithologic structure
- 海食崖 Cliffs by marine processes
- 流水による崖 Cliffs by fluvial, nival-fluvial processes

3）尾根 Ridges: mostly structural

- 小規模尾根 Minor ridge landforms by lithology and foliation
- ナイフリッジ Knife ridge, very sharp
- 平頂～円尾根 Flat-topped or rounded ridge

4）谷地形 Valleys

- 盆状Ｖ字小谷 Trough-shaped valley～V-shaped valley
- 岩石制約性線状小谷地形 Rock-controlled linear valley like landform

5）凸地形，凹地形 Hillocks and Depressions

- 独立小丘 Hillocks
- 凹　地 Small depressions

2．地形営力域 Area of geomorphological processes

- 氷河成 Glacial　濃：堆積性 Dark: depositional　淡：侵食性 Light: erosional
- 海　成 Marine
- 河成～融雪水流成 Fluvial, Nival-fluvial
- 風　成 Eolian, Niveo-eolian

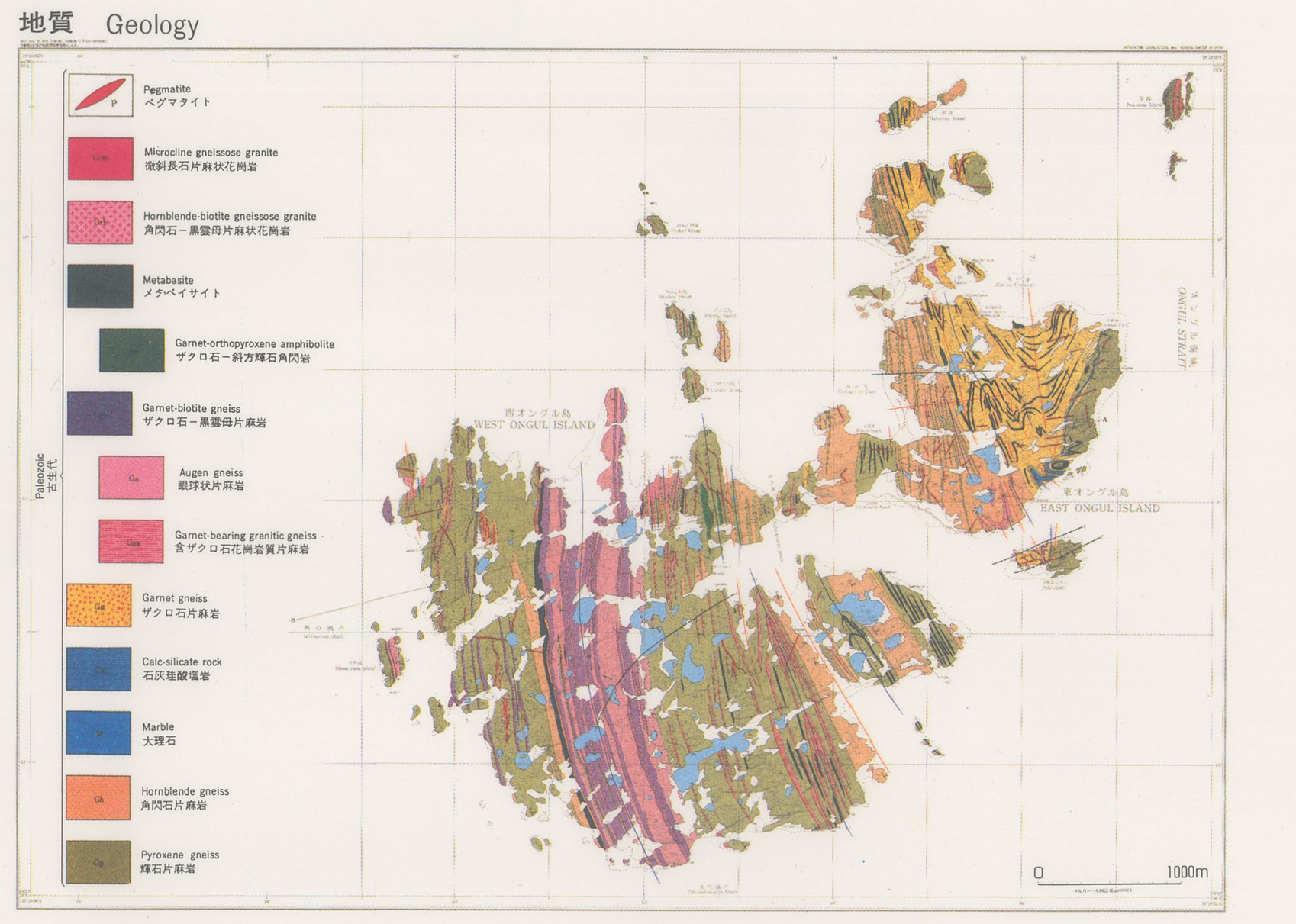
3．地形営力と現象 Individual geomorphological processes and their traces

- 巨大迷子石 Large block of erratics
- 氷河擦痕とその方位（R：羊背石） Glacial striae (R：well polished Rundhöcker. 25：direction of striae)
- 蜂の巣状風化 Honneycomb weathering
- 凍結破砕作用 Frost shattering
- 巨大多角形土 Tundra polygons
- 崩　落 Rock fall
- ペーブメント Pavement
- 永久凍土活動層崩壊 Permafrost active layer collapse
- 周氷河性クリープ，ソリフラクション Periglacial creep, gelifluction
- 融雪水流ウオッシュ Nival-fluvial slope wash
- 風稜石 Ventifacts
- 貝化石 Fossil shells
- 放棄されたペンギン営巣地 Abandoned penguin rookery

4．陸水 Inland water

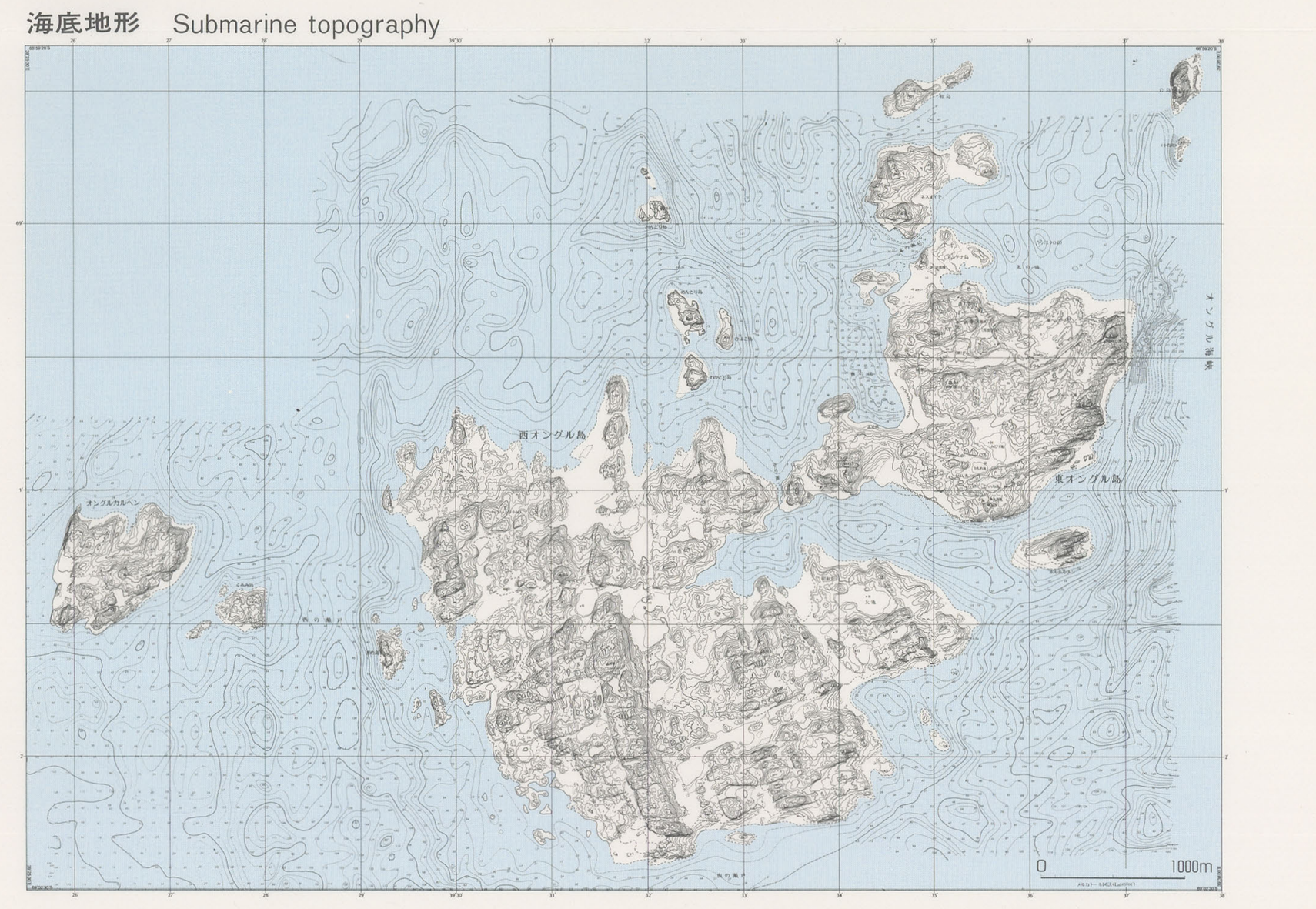
- 池 Lake
- 堆　雪 Snow drift

地質 Geology



Quoted from Ishikawa, M., Shiraishi, K., Motoyoshi, Y., Tsuchiya, N., Shimura, T. and Yanai, K. (1994)

海底地形 Submarine topography



Data sources: Fujiwara, K. (1971), Hayashi, M. (1977), Moriwaki, K. (1978) and Sawagaki, T. (1995)

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