guinea pig lung, showing many lamellar forms in an alveolar epithelial cell. To estimate their number in the normal animal, we counted only the cells containing six or more lamellar forms. This method markedly underestimates the number of lamellar forms in the normal lung. In 11 sections from two normal guinea pigs there were 26.2 ($\pm$ 9.1) lamellar forms per grid division of the electron microscope. Figure 2 shows a characteristic section of lung from a vagotomized guinea pig. The amount of lung tissue in sections from normal and vagotomized animals was similar. The alveolar epithelial cells of the vagotomized animals show vesiculation of the cytoplasm and only rare mitochondria. Because there were so few lamellar forms in the tissue from the vagotomized animal they could be fully counted. In 29 sections from three vagotomized animals the count per grid division was 3.9 ($\pm$ 3.1). This difference suggests a relationship between surfactant and mitochondrial transformation.

The third experiment further explored the origin of the surfactant. We prepared subcellular fractions from 12 rabbit lungs in 1-percent crystalline bovine serum albumin, 0.18*M* KCl and 0.01*M* ethylenediaminetetraacetic acid, *p*H 7.2, by homogenization and centrifugation (*14*). After isolation, the mitochondrial fractions and microsomal fractions were washed twice with the medium. Each subcellular fraction and the final mitochondrial wash were layered on saline or 1-percent albumin solution, and the surface tension of each was measured as described above. The minimum surface tension of the washed mitochondrial fraction of lung was 11.5 ($\pm$ 7.2), of the microsomal fraction 24.8 ($\pm$ 2.6), and of the last mitochondrial wash 24.3 ($\pm$ 3.7) dyne/cm. Surface tension of the last four mitochondrial fractions measured on 1-percent albumin was 6.2 ($\pm$ 4.9) dyne/cm. Albumin did not lower the surface tension of the microsomal fraction or the last mitochondrial wash. Washed mitochondrial fractions prepared in the bovine albumin and KCl medium from rabbit liver, heart, brain, and kidney did not reduce surface tension below 24.0 dyne/cm in any preparation. The washed mitochondrial fraction prepared from lung had surface activity characteristic of the whole lung extract.

The above evidence supports the hypothesis that the surface active lining of the lung develops during the process of lamellar transformation of mitochondria in the alveolar epithelial cell. Direct evidence of secretion onto the surface has not yet been obtained (*15*).

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Bedrock Geology of the Thiel Mountains, Antarctica

Abstract. Cordierite-bearing, hypersthene-quartz monzonite porphyry, the most widespread rock unit, is intruded by biotite granite and porphyritic biotite granite. Sedimentary and metasedimentary rocks, mainly quartzites and argillites, have been metamorphosed locally to hornfels and have been involved in high-angle faulting. Shear zones are common in the plutonic rocks.

The Thiel Mountains, which have previously been referred to informally as the "eastern Horlick Mountains," are located in western Antarctica about 330 miles from the South Pole (Fig. 1). Their elevations range between 7000 and 10,000 feet, their relief between 3000 and 4000 feet. They were studied by U.S. Geological Survey mapping parties (*1*) in the austral summers of 1960–61 and 1961–62, and the area between latitudes 85°45′S and longitudes 86°00′ and 95°00′W was mapped.

In 1958 and 1959 two parties concerned primarily with geophysical and glaciological studies approached these mountains, which, it was then believed, formed the eastern end of the Horlick Mountains. W. H. Chapman of the U.S. Geological Survey, a member of the 1958–59 U.S. Horlick Mountains oversnow traverse from Byrd Station, determined the geographic location of the north end of the Thiel Mountains in December 1958 from a point about 30 miles away. These and later geodetic studies showed that the Thiel Mountains are a distinct mountain group. In the 1959–60 season, the late Edward Thiel and a small party visited (by plane from Byrd Station) the ice plateau near the southern end (*2*).

The Thiel Mountains consist of a large, nearly flat-topped massif joined to a group of high nunataks by a southeast-trending ice escarpment 20 miles long. Numerous small nunataks lie along the escarpment, and others are present at distances ranging from a few miles to about 40 miles from the main massif. The mountains form part of the great chain of ranges that crosses the continent from the Ross Sea to the Weddell Sea. Prior to investigations during the International Geophysical Year the more isolated interior portions of this transantarctic mountain system were unknown geologically as well as geographically. Even at present, except for a few small areas where detailed work has been done, geologic data are limited. In general structure, the transantarctic ranges have been considered for a long time to be a large horst system (*3*), but more recently Hamilton (*4*) found evidence of broad domical structure defined by sedimentary rocks—Beacon sandstone—in the McMurdo Sound region. Because of the absence of such rocks in place in the Thiel Mountains, a possible domical structure cannot be demonstrated. On the other hand, the mesalike topographic form of the mountains and the presence of numerous shear zones and faults suggest fault-block structure.

Medium-gray quartz monzonite porphyry is the most widespread rock. The

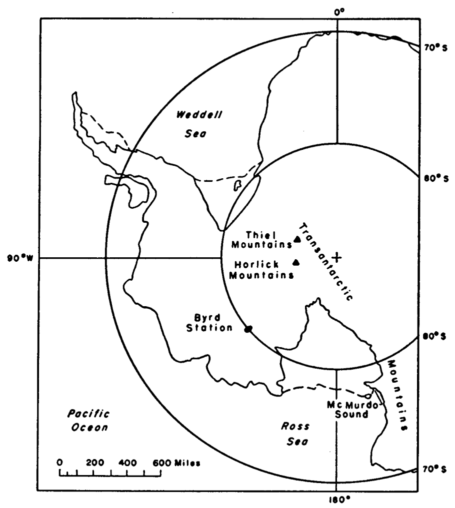

Fig. 1. The Thiel Mountains.

mass has a minimum dimension of 20 miles north-south and 15 miles east-west. On fresh surfaces the rock appears almost even grained, but where weathered the alteration products on feldspars make the strongly porphyritic, nonseriate texture evident. Large and strikingly euhedral insets of purple cordierite are conspicuous at many places. Pleochroic halos around zircons included within cordierite are common in thin sections. Strongly pleochroic hypersthene, generally rimmed by alteration products of talc, chlorite, and green and brown biotite, is the chief mafic constituent. Only rarely does primary biotite occur. At several localities a vague to distinct light and dark layering is present and at two places such layering defines large, open folds. Preliminary petrographic studies show that the layered rocks are mineralogically the same as the more massive rocks. The darker layers, however, have a considerably higher ratio of matrix to phenocrysts than the lighter layers.

A stock of medium-grained biotite granite, intrusive into the quartz monzonite porphyry, is well exposed on a large nunatak on the ice escarpment. Near the contact the quartz and potassium feldspar of the porphyry have been thoroughly recrystallized and have a granoblastic texture. Anhedral hypersthene and poikiloblastic biotite are the chief mafic minerals of the recrystallized porphyry. Very similar granoblastic rocks make up a small nunatak about 20 miles northeast of the massif. Owing to the brownish color of their feldspars and their granoblastic textures, hand specimens of the recrystallized rocks appear to be very similar to charnockites from near Mawson station on the East Antarctic coast.

The quartz monzonite porphyry has also been intruded by a large body of very coarse-grained porphyritic biotite granite. The intrusive relationship is demonstrated by a wide zone of contact breccia containing large blocks of quartz monzonite porphyry that have been contact metamorphosed. Dikes of porphyritic granite cut the quartz monzonite porphyry.

Porphyritic biotite granite forms massive, light-colored cliffs and nunataks in the northwesternmost part of the mountains. It is also exposed on a small nunatak nearly 40 miles away at the southern end of the mountains and therefore may underlie much of the area.

The geologic age of the crystalline rocks is unknown at present. The charnockitic affinities of some of the rocks, however, suggest a Precambrian age by analogy with charnockitic rocks of the East Antarctic shield. More exact dating will be provided by lead-alpha and isotopic studies of zircons in the hypersthene-quartz monzonite porphyry and by isotopic studies of mica and potassium feldspar in biotite granite.

Nearly flat-lying sedimentary and metasedimentary rocks and sill-like bodies of dacite are exposed in several of the peaks in the southeastern end of the mountains. The sediment-derived rocks are chiefly quartzites, argillites, and slaty argillites. Cross bedding is well developed in some quartzites, and the argillites commonly show ripple marks and mud cracks. Locally, near intrusive bodies, spotted hornfelses have formed. At several places these rocks have been involved in high-angle faulting. No recognizable fossils were found, but specimens containing features possibly of organic origin were collected and are awaiting further study.

Although detailed comparisons have not yet been made, these rocks appear to be lithologically different from the Paleozoic sedimentary rocks that lie on plutonic complexes in the Horlick Mountains and elsewhere in the Transantarctic Mountains. Diabase bedrock, accompanied by numerous erratics of white sandstone, is exposed in the southernmost nunatak; therefore Beacon-like rocks may lie beneath ice escarpments seen farther south (*5*).

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References and Notes

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Electron Spin Resonance of Nitric Oxide–Hemoglobin Complexes in Solution

Abstract. The electron spin resonance spectra of solutions of nitric oxide–hemoglobin and nitric oxide–methemoglobin, and whole blood treated at room temperature with nitric oxide, all exhibit resonance with a line width of 83 gauss, a g-value of 2.03, and a spin intensity corresponding to one unpaired electron spin per heme. The minimum detectable concentration of these nitric oxide complexes in solution is $10^{-5}M$. Solutions were stable in a nitrogen atmosphere but when exposed to air in the absence of nitric oxide the spin intensity decreased with a half-life of about 5 hours. A preliminary examination of blood of rats exposed 1 and 9 days to 10 ppm of nitric oxide in air showed no electron spin resonance.

Nitric oxide (NO) is the major component among the oxides of nitrogen in smog, comprising at least half of the total oxides of nitrogen and, at periods during the day, almost the entire amount (*1*). Under appropriate photochemical conditions, it is oxidized slowly to nitrogen dioxide (NO_2) (*2*), which is known to be toxic at relatively low concentrations (*3*), whereas NO injures biological material only in much higher concentrations under experimental conditions (*4*). However, the fact that NO can bind firmly with both hemoglobin (Hb) and methemoglobin (MHb) led us to investigate the possibility that it may enter the blood circulation through the lungs and combine with Hb. Gibson and Roughton (*5*) described the strong complexing of NO, relative to oxygen, with Hb in vitro and demonstrated the slow dissociation of nitric oxide–hemoglobin (HbNO).

The electron spin resonance (ESR) technique was employed to investigate the concentrations of HbNO and nitric oxide–methemoglobin (MHbNO) in