affect a neural mechanism, such as that postulated by Fuller and Smith (*4*), involved in seizure susceptibility. Our report supplies information regarding the relationship between dilute coat color and audiogenic seizure susceptibility in mice.

The strains most commonly used for comparisons of audiogenic seizure susceptibility (DBA/1 and C57BL/6) were not available where we performed the experiments (*5*). A testing program (with "standard" equipment, that is, a doorbell and metal bucket) revealed two alternative strains which were suitable for comparison (*6*). Susceptible individuals were found among mice of strain P, and a subsequent selection program increased their frequency. A related strain, J, produced no susceptible mice among over 500 tested. Like DBA, the P strain is homozygous for the recessive gene dilute; the J strain does not carry this allele. All mice used in crosses were first tested and classified, so that all P parents were known to be susceptible, and all J parents, nonsusceptible.

Mice from crosses resulting in segregation of coat color phenotypes (F_2 and backcrosses to P) were tested for seizure susceptibility. Each animal was given a single 1-minute exposure to sound at 35 to 40 days of age. Mice showing convulsive behavior were classified as susceptible.

As expected, all four possible categories of mice occurred: dilute-susceptible, dilute-nonsusceptible, nondilute-susceptible, and nondilute-nonsusceptible. Among the total number of mice tested, the dilute phenotype occurred in frequencies which conformed closely to the theoretically expected frequencies

Table 1. Frequencies of dilute phenotype among all progeny and among susceptible progeny only.

Generation	Total progeny		Susceptible progeny	
	No.	Frequency of dilute	No.	Frequency of dilute
F_2	236	.25	26	.42
Backcross	112	.53	27	.67

Table 2. Chi-square values from tests of independence between dilute coat color and seizure susceptibility.

Generation	χ^2	d.f.	P
F_2	4.668	1	$<.05$
Backcross	2.404	1	$<.20$
Combined	7.072	2	$<.05$

of .25 (F_2) and .5 (backcross) (Table 1). However, among the susceptible animals from both crosses, the frequencies of the dilute phenotype were greater than expected. Tests of independence between the two factors, coat color and susceptibility, were made (Table 2). Failure to detect all susceptible individuals would tend to bias the results toward an incorrect conclusion only if the factors are dependent, since in this case a higher proportion of dilute than nondilute animals would be shifted to the nonsusceptible classification, and the only ratio which would remain unchanged (susceptible-dilute: susceptible nondilute) would be based on fewer observations. The combined chi-square value indicates that mice with the dilute phenotype are more likely to be susceptible than are nondilute mice. The higher probability of a chance contingency indicated by the backcross data may be due to the smaller number of animals in this group. Also, nondilute mice among the backcross progeny consist entirely of heterozygotes, whereas in the F_2, on the average, one-third of the nondilute animals are homozygous for the nondilute allele. Coleman's data indicate that alleles at the dilute locus tend to behave in an additive manner. Therefore, if their action does influence the incidence of seizures, nondilute homozygotes might be less prone to seizures than heterozygotes.

Although linkage of a factor affecting susceptibility with the dilute locus cannot be ruled out, the relationship between phenylalanine hydroxylase activity and dilute alleles provides a mechanism through which direct influence on audiogenic seizure susceptibility is possible.

The animal stocks used in this investigation do not offer the best approach to this problem, because: (i) interstrain crosses result in segregation at loci other than those under investigation; (ii) the P strain carries the gene for short ear, which is very closely linked to dilute; and (iii) crosses between strains P and J yield a smaller proportion of animals susceptible to audiogenic seizures than do crosses involving the DBA strain. Further research, which will eliminate these difficulties, is now underway, through utilization of a mutation from dilute (*d*) to dense (*D*) which occurred in the DBA strain and was used by Coleman in his biochemical analysis. Tests of the incidence of seizures among *DD*, *Dd*, and *dd* individuals on a common genetic background, and experiments to determine whether or not this incidence can be altered by treatment with chemicals which are involved in the metabolic activities related to the dilute locus are expected to clarify the role of the alleles at this locus in influencing the incidence of audiogenic seizure susceptibility in mice (*7*).

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5. This project was carried out while we were located at the Department of Genetics, Iowa State University, Ames.
6. Both strains were obtained from Dr. W. F. Hollander, Iowa State University.
7. This work has received assistance from the U.S. Atomic Energy Commission, contract No. AT(11-1)107 at Iowa State University.

24 November 1961

Sedimentary Rocks of the Buckeye Range, Horlick Mountains, Antarctica

Abstract. In the Buckeye Range of the Horlick Mountains, 4000 feet of sedimentary rocks nonconformably overlie a granitic basement and underlie a thick diabasic sill. The sedimentary section consists of Devonian sandstone and shale (Horlick formation), Carboniferous (?) tillite (Buckeye formation), Permian (?) platy and carbonaceous shale (Discovery Ridge formation), and Permian arkose, shale, and numerous coal beds (Mount Glossopteris formation). This apparently is the first report of a Paleozoic tillite in Antarctica.

This paper names and presents a preliminary report on the stratigraphic units of the Buckeye Range (Fig. 1) which will serve as a basis for further geologic investigation in this area. The Buckeye Range is the proposed name for the central range of the Horlick Mountains, located about 5° from the South Pole at 84°45′ S and 114° W. This section seems more complete than the sections of other antarctic areas, and it shows a greater degree of resemblance to the Gondwana age deposits of Australia, India, South Africa, and South America. The most notable feature involves recognition of a thick section of late Paleozoic tillite.

Nearly all rocks are flat-lying or of

low dip. The basement consists of a porphyritic quartz monzonite mass in nonconformable contact with the sedimentary rocks. The old erosion surface is of low relief and mature topography, and the nonconformable contact can be clearly seen for a distance of about 20 miles along the front of an ice-free escarpment.

Coarse, poorly sorted sandstone with marine fossils and dark shale directly covers the basement in most places; this unit is up to 150 feet thick. Invertebrate fossils are similar to those of the Bokkeveld fauna of South Africa and referable to the Siegenian or Emsian stage of the early Devonian (*1*). More extensive later collections are now under study by G. A. Doumani of the Institute of Polar Studies. Fragments of land plants are included in the dark shales, and a favorably preserved early Devonian spore assemblage is present (*2*). This basal clastic unit is named the Horlick formation.

Overlying the Horlick formation is a unit about 800 feet thick composed of bluish-gray, silty, clayey matrix which includes pebbles, cobbles, and boulders of mixed lithology in an unsorted arrangement. The unit rests on a striated and grooved pavement that truncates the Horlick formation and parts of the basement rock. The lithology of included pebbles shows about 70 percent sedimentary rocks, 23 percent igneous rocks, and 7 percent metamorphic rocks, all of uncertain source. More than 90 percent of the pebbles counted are subrounded to angular with about 40 percent subangular. About 10 percent are striated; an example of a striated cobble is shown as the cover photograph of this issue. Evidently these beds are of glacial origin and correspond to the well-documented Permocarboniferous tillites in Gondwana deposits of the southern hemisphere. Within the unit a boulder pavement shows crag-and-tail features indicating glacial movement from west to east. The sandstone beds within the tillite are presumed to be deposited by water during ice retreats. The Gondwana tillite of South America, Africa, India, and Australia ranges in age from Carboniferous to early Permian (*3*) and constitutes some basis for presuming that the tillite of Antarctica is referable to the same time interval. No fossils have yet been found in the tillite so it is possible that a Devonian glaciation could be represented, but relations with units above the tillite are similar to those in South Africa. These relations suggest that a Carboniferous age is most likely. This sequence of ancient glacial deposits and included clastic beds is named the Buckeye tillite.

Overlying the Buckeye tillite with apparent conformity is a unit of dark-gray, platy shale which grades upward into carbonaceous shale containing thin cone-in-cone limestone beds in the upper portion. The unit is about 550 feet

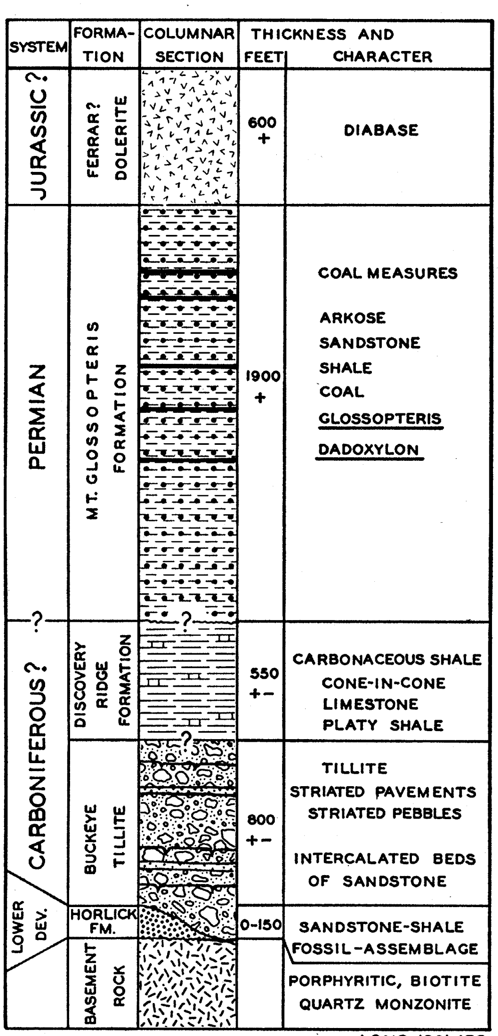

Fig. 1. Stratigraphic section from the Buckeye Range, Antarctica.

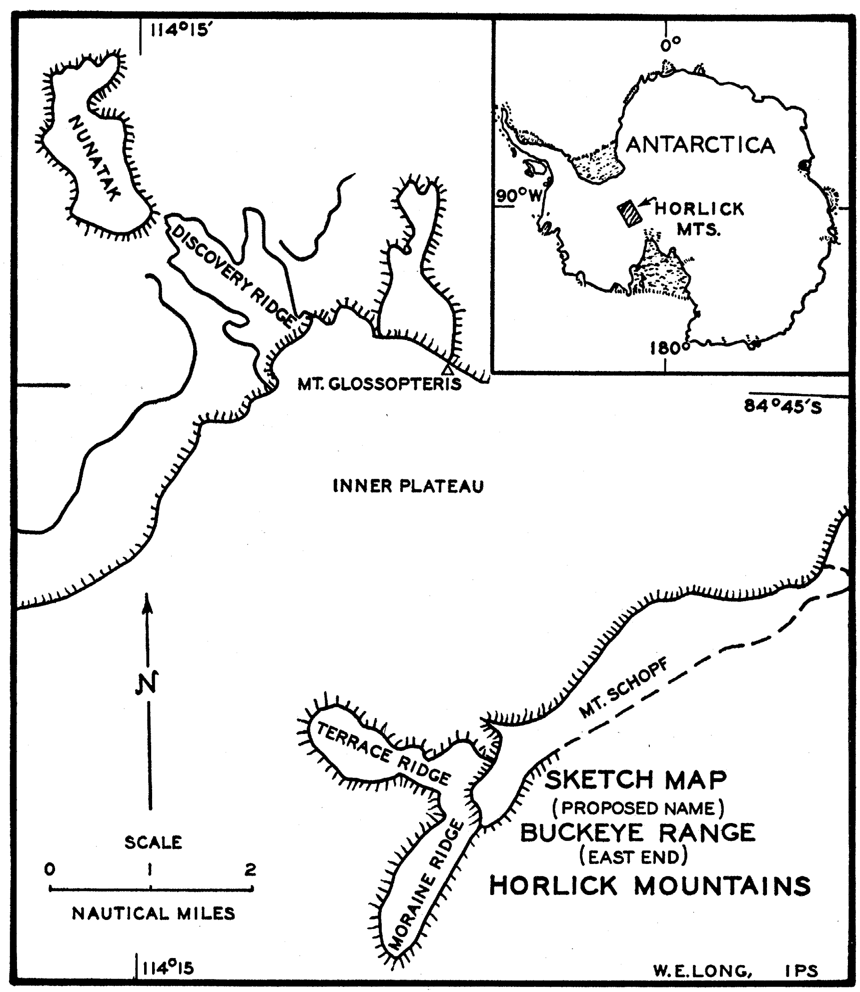

Fig. 2. Sketch map of the Buckeye Range. The section (Fig. 1) was measured on the east slope of Discovery Ridge and the west slope of Mount Glossopteris. Mount Schopf includes the uppermost part of the section and is capped by the Ferrar (?) dolerite. The inset shows the location of the Horlick Mountains.

thick. No fossils have been identified, so its age is uncertain, but relations with beds above and below suggest that it may be Carboniferous or Permian. This unit of platy and carbonaceous shale is named the Discovery Ridge formation.

The youngest sedimentary rock unit of the Buckeye Range includes about 2000 feet of light gray and brown, arkosic sandstone, interbedded with dark shale and coal. This unit is called the Mount Glossopteris formation; its contact with the underlying Discovery Ridge formation is uncertain, but the lithologic change is sharp and it is also differentiated by abundant evidence of plant life and terrigenous accumulation. In addition to coal, leaves of *Glossopteris*, wood of *Dadoxylon*, spores, and other evidences of gymnospermous and cryptogamic plants are present. The age of the Mount Glossopteris formation, as indicated by the fossil plants, is probably Permian (*4*).

A diabase sill about 600 feet thick is the highest and youngest exposed unit. The sill was evidently intruded into the Mount Glossopteris formation, and subsequent erosion has removed an unknown thickness of sedimentary rocks and diabase from the present top surface. Coal from the upper part of the Mount Glossopteris formation has been devolatilized and become anthracite or semianthracite owing to the heat of igneous intrusion. A bed within 960 feet of the sill shows 18.9 percent volatile matter (moisture and ash free) (*5*). The diabase sill is similar in composition to the Ferrar dolerite (*6*) as designated by Harrington (*7*). The Ferrar dolerite occurs in large intrusions in Victoria Land, and similar sills along the Oates Coast have been dated as probably Jurassic (*8*). Sills of similar age have been found in other Gondwana areas.

In an earlier report (*9*) resulting from a single ascent of the section (Fig. 2), tillite was incorrectly identified as graywacke.

Continuing field studies in the area are being conducted during the 1961–62 Antarctic season by geologists of the Institute of Polar Studies at Ohio State University. A recent request for formal stratigraphic terms (*10*) has prompted the use of suitable names for formations of the Buckeye Range at the present time (*11*).

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10. This request was made by R. W. Willett, chairman of the Permanent Working Group on Geology, Special Committee on Antarctic Research, in a personal communication on 3 July 1961.
11. The material given here has also been presented in a master's thesis at Ohio State University (Department of Geology) with informal stratigraphic terminology used; that is "coal measures" rather than Mount Glossopteris formation, and so on.

12 October 1961

Basal Skin Resistance during Sleep and "Dreaming"

Abstract. Basal skin resistance was measured continuously in sleeping human subjects. Instead of a hypothesized fall in basal skin resistance during periods of "dreaming" or emergent stage 1 electroencephalographic activity, there was a rise which generally coincided with the "dreaming" period. This finding, along with other recent studies, indicates that this stage of sleep is not just a light stage of sleep but is unique neurophysiologically.

In 1955, Aserinsky and Kleitman found a high incidence of dream recall in subjects wakened from sleep during periods of rapid conjugate eye movements (*1*). Dement and Kleitman (*2*) and Goodenough *et al.* (*3*) subsequently showed that "dreaming" occurred during a particular level of sleep as indicated by the electroencephalogram, called stage 1. It was assumed that this stage, which occurs in four to five cycles during the night, represented a light stage of sleep.

Numerous investigators have demonstrated that the basal skin resistance is inversely related to level of arousal (*4*). States of relaxation are accompanied by high skin resistance, which reaches a maximum during sleep. Situations leading to increased arousal such as states of anxiety, presentation of emotionally charged words, or requiring a subject to perform mental arithmetic lead to decreases in skin resistance. This phenomenon, which is thought to be related to the permeability of the membranous lining of the sweat glands, is mediated by the sympathetic nervous system and seems to be related to the activity of the reticular activating system (*5*).

If the stage 1 level of sleep during which dreaming is presumed to occur is the lightest level of sleep, and if the inverse relationship of basal skin resistance to level of arousal is correct, it would be expected that there would be a fall in skin resistance as the sleeper passes from stages 2–4 to stage 1. It would also be anticipated that as the subject returns to stages 2–4 the resistance would rise again.

Fifteen "normal" young adult subjects varying in age from 19 to 35 years were studied in the laboratory during 2 to 3 nights of natural sleep for a total of 33 subject-nights. Continuous tracings were recorded on a Grass III-D eight channel electroencephalograph (EEG). Orbital leads were used to record eye movements. A model 201, Bio-Physical GSR amplifier was used to measure skin resistance. The instrument impresses a current of 10 $\mu a/cm^2$ of electrode. The electrode was a 1- by 2-cm lead electrode which made contact with the skin through 0.05*N* sodium chloride electrode paste. A 5- by 5-cm lead reference electrode was taped to the upper arm.

Basal skin resistance rose as the subject fell asleep. There was an overall

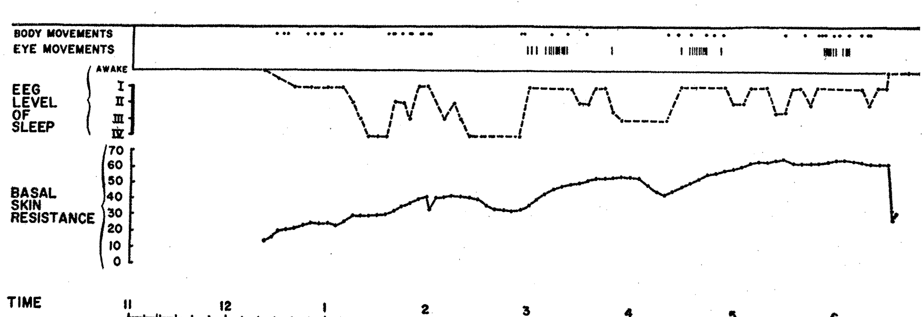

Fig. 1. Relationships between basal skin resistance, EEG level of sleep, rapid eye movements, and body movements during a night of uninterrupted sleep in the laboratory.