Prof. Lester King, guest speaker of the evening at the dinner of the Antarctic Association, delivering his address. On his right, Dr. D. G. Torr and Mrs. R. Kirton, wife of the Regional Director of B.P. (S.A.) and on his left Mrs. Torr.

Photo: B.P. (S.A.)

Geological Similarities Between Antarctica and South Africa

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I have been preparing this address for a long time. In fact, I have been preparing it since 1910, when at a place called Lyttelton, New Zealand, I then watched a black ship leaving for Antarctica. It was Captain Scott's *Terra Nova*! I wanted to go too, but had to wait 50 years before I stood at South Pole.

Those of you who have been outdoor members of an Antarctic expedition, particularly geologists, will know of the unusual difficulties associated with one's studies there. Firstly, there are many miles between rock outcrops and much foot travelling across snow and ice is necessary. At SANAE, where dogs are still used for travel, the nearest outcrop is 70 miles distant, and the travelling is still laborious and time-consuming. Then when you do arrive at the next outcrop and bend to pick up a rock, excited and breathing hard, your glasses become so iced up that you cannot see anything anyway. Secondly, only once will you pick up a rock with your bare hands, as you will very quickly discover that it has been at subzero temperatures for the last hundred thousand years, and still is. Nevertheless it is worthwhile to geologists for the rocks in Antarctica are clean and sound. There is no weathered zone and no soil to cover them up. On the other hand rock outcrops are apt to be extraordinarily steep, and sometimes even inaccessible.

The hardship and toil endured in specimen collecting may be illustrated by the journey of a student of mine who recently spent three years in Antarctica. Juckes had a long sledging season with a team of dogs from the base at Halley Bay. He sledged for 205 continuous days and covered 1,400 miles on his own feet. He sledged 300 miles from the base before encountering his first piece of rock, and when he had finished geologizing late in the season, he had a 300 mile walk home! He lectured on this journey in Durban and at the end of the lecture a lady enquired: "You told us how in Antarctica you often went thirsty because there was no water, and you lived in a little tent. Whenever did you bath?" With great dignity the young man replied: "Madam, we bathed regularly every two months, whether we needed it or not".

These old ways are changing rapidly. Some Antarctic Expeditions now use mechanical toboggans, snowcats, muskeg tractors and helicopters, and these sophisticated vehicles make travelling much more comfortable. Nowadays also one does not have to stay through the polar winter as in the days when ships could pass through the pack ice only at high summer. Scientists are now flown in and not only do the American geologists go down for the summer season only, some Russian geologists don't even go down at all. They work differently. The Soviets send down what you may call polar dwellers, men who will spend years in the Antarctic or the Arctic. They are technicians, qualified to travel and collect the specimens, which are then sent back to experts in U.S.S.R. who, although they may not go down to Antarctica, do the actual scientific work.

This method, of course, is not entirely original. I see before me Dr. Edna Plumstead of world reputation, who studied the fossil plant material sent back from Sir Vivian Fuch's Trans-Antarctic Expedition. We are proud of both Sir Vivian Fuchs and Dr. Edna Plumstead as geologists.

ANTARCTIC ROCKS

In terms of rock types, the rocks of the Antarctic are just the same as the rocks of other southern continents. If you can get these rocks in South Africa, why then go down south for them anyway? The scientific answer is that you can never be sure. While it is very important to determine whether they are different, it is also important to determine whether they show similarities with those in Africa, South America and Australia. On this rests one of the most far-reaching geological theories of recent years. . . . . *The Theory of Continental Drift* under which it is believed that all the southern continents at one time were conjugated into one supercontinental land mass. Therefore it is important to determine the likenesses in the rocks. There are some extremely interesting stories on this, particularly to South Africans, because in all the history of geological comparison from continent to continent, one name stands pre-eminent. It is that of the late Dr. A. L. du Toit. There is a whole school now of South African geologists, who have been

convinced that his theory is correct and some who seek further proof of this theory, as between South Africa and Antarctica.

For the last seven years we have had South African geologists sledging from SANAE to the outcrops in the south. The rocks they are bringing back are exceedingly interesting from the point of view of a very close connection in early times between two countries and continents.

Those of you who have lived in the highveld and in the Karoo know that most of the strata there lie flat in a great system of thousands upon thousands of feet of sedimentary rock, which is called the *Karoo System*. This is subdivided into a number of rock series which are given local names. These rocks are well known to exist in Antarctica also. They have been known from the earliest Antarctic expeditions, from the Scott Expedition of 1901-04, when Dr. Ferrar (also born in South Africa) was the first geologist to spend a whole two years in the Antarctic.

Ferrar's work on what is called the *Beacon System*, showed there great sills or sheets of dolerite rocks that came in red hot from volcanic reservoirs below intruding through and between the layers of sedimentary rock. We have precisely the same over a great part of the highveld and the Karoo in South Africa where are hundreds of koppies with a little hard cap of black dolerite rock. The same dolerite extends widely throughout the Antarctic. We always hoped to find in the Antarctic a very ancient glacial type of rock well known in South Africa, called the *Dwyka tillite*. Those who believed in continental drift always thought that this remarkable rock type must be found some day in the Antarctic.

And it was found: by Bill Long of America, working in the Horlick Mountains. Long was later persuaded by Dr. Adie of British Antarctic Survey, and a former geology student of Natal University, to come to South Africa to make the final comparative studies.

This study had a further corollary in the Antarctic—underneath those rocks were still further horizontally stratified rocks belonging to a previous age which were not exposed in South Africa. I was told by Dr. Edna Plumstead, however, that she had encountered them underneath the glacial rocks in the cores from bore holes in the Free State goldfields! So in Antarctica was found a rock system which we had long known here and, conversely, we have discovered in South Africa a rock system which was first known from the Antarctic.

In the Antarctic in the early days, above the known Beacon strata (which have the coals in them and the same plant fossils as the Karoo formation in this country) there comes another rock series called the *Falla Formation*. In South Africa we call it the *Beaufort System* and here it has yielded for over a hundred years famous fossils of reptiles just in the stage when the reptiles changed to the mammals. We would like to find such fossils in the Antarctic. We know so far of only two places where they may occur. One is in Victoria Land, where there are Triassic-Jurassic rocks, but nobody has found them as yet. The other is on the 14,000 ft. Mount Kirkpatrick, right at the head of the Beardmore Glacier, where the New Zealanders have done some work. It is a forbidding place. W. G. Grindley has done magnificent work there but found no fossils. On top of this formation appear finally the Drakensberg basalts, capping the whole sequence of Beacon/Karoo sedimentary beds with volcanic lavas, hundreds and thousands of feet of them, just as in South Africa. Truly the comparison between the rock formations of these rock systems developed in now widely sundered continents is remarkable, and could not have originated with the two landmasses so far apart in their present positions.

FOSSILS

Fossils tell us many things. The name *Glossopteris* which betokens a plant fossil very often found as leaves, is well known to many South Africans. Out of *Glossopteris* much of our South African coal has been made. The same *Glossopteris* also comes from the Antarctic where there is a coal field 1,200 miles long! The first *Glossopteris* fossils were discovered there by Captain Scott's party on their return from the South Pole in 1913. At the Buckley nunatak, at the head of the Beardmore Glacier they took their samples and put them on their sledges. They dragged those sledges and the fossil leaves until they died upon the Ross Barrier. The fossils were recovered the next year when the bodies of Scott and his companions were found.

GEOMORPHOLOGY

Following 1939 a classification of African landforms was made that enabled them to be studied systematically in terms of earth history. These studies were later extended to other continents which were found to have had similar histories of landscape development.

The question then arose whether the landscape of Antarctica, most of it nowadays below the ice, could have had a similar mode of development and history. This had been my own particular study.

The only way to find out was to go there and study those places where rock landscapes were visible. This was done in two visits, one in 1961/2 and the other in 1963. The task was not easy, as you can well imagine. But the upshot of the story was this: if the ice was removed from Antarctica the landscape underneath would be just the same as the landscape of other continents, carved by the sun, wind and rain, with running rivers and soil covered hillsides, with wide plains, scarps and mountain uplifts. As all this was still determinable, the ice must be relatively recent (one or two million years only) in the Antarctic. It was no older there than was, say, the ice on the Alps, the Himalayas, the Andes or any other glaciated regions, and prior to the accumulation of the ice the Antarctic seems to have been a relatively temperate land, like most others are now. The Ice Age has been a relatively transient thing in geologic history. Vanished now from northern Europe, and from most of North America, it is slowly disappearing also in the Antarctic of today.

Not only could it be determined that the pre-glacial

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