

SCIENTISTS PHOTOGRAPH SOLAR ECLIPSE FROM REMOTE POINT TO MAKE TEST OF EINSTEIN THEORY

By W. B. CAMPBELL
 Director of Lick Observatory, University of California, and head of Crocker Expedition to Australia to record total eclipse of the sun.

San Francisco, Dec. 11.—The observing station selected for the total solar eclipse of September 21 was Wollai, a combined post and telegraph office on the northwest coast of Australia a mile and a half inland from the "Ninety Mile Beach." The inhabitants of the Wollai region, say 300 square miles in area, consisted of six white men, several scores of Aborigines (blacks) and some tens of thousands of sheep.

The tides on the Ninety Mile Beach have a range of 26 feet and Wollai was announced, two years ago, to be hopelessly inaccessible. On that account the expedition from the Greenwich observatory went to Christmas Island, a thousand miles west-northwest of Wollai.

The conditions at Wollai were so promising, however, that I was most anxious to send an expedition to that point. In the past 25 Septembers rain had fallen at Wollai only twice and then in minute quantities; the eclipsed sun would be high in the sky; and the duration of totality would be longer than at any other possible observing station—five minutes and 19 seconds, an unusually long eclipse.

Last year I suggested to Father De-roy, a well known astronomer in Sydney, that it would be fine if the government of Australia should detail a naval vessel to transport the California expedition from Fremantle, to Wollai and return. Pegot presented the case to the government and the decision was favorable.

The government went much further, in that it volunteered free railway and sleeping car transportation from Sydney to Fremantle and return, the camp equipment and the services of 19 officers and men of the Australian navy to maintain the camp and to assist with the heavy work of mounting and sheltering the instruments.

When the Crocker expedition reached Sydney on August 5 it was met by commandant Commander Quick, who charged with the duty of personal-ducting the astronomers all the to Wollai and return and of admin-

istering the living arrangements at Wollai.

At the eleventh hour the navy's plans were changed. At Fremantle the astronomers and their many tons of instruments were placed on board the Charon, one of the regular steamers running in eight days to Broome, about 200 miles northeast of Wollai.

Broome, a village of 2,000 Chinese, Japanese and Malays and 400 whites, is the center of the world's most noted pearl fisheries. At Broome—there were five expeditions by this tin—from California, from Toronto, from Cambridge, England; from Perth, Australia, and from India—the transfer to an 80-ton schooner was made. A small government steamer towed the schooner to Wollai, where it anchored three miles from shore on the morning of August 30.

We went ashore at once to select the exact spot for the observing station. The naval contingent brought the 70 tons of equipment by means of a small lifeboat from the schooner to shallow water near shore, and 40 or 50 blacks carried the packages from the boats to dry land. Donkey wagons—25 donkeys to one wagon—transported them over the sand ridges to camp. Nothing was lost or broken.

The work of preparing the instruments for the eclipse was very heavy, lasting from sunrise to dark, with many extensions into the night for securing star photographs needed in the adjustments and tests of the apparatus.

The days were hot, but the air was very dry and the nights cool. Every one of the 25 days from August 30 to September 21 was beautifully clear. Notwithstanding the millions of the most insistent and insidious flies ever encountered, and no provision for keeping them out of the kitchen, dining tent and living tents, there were no cases of illness. The locality was naturally healthy in the extreme. The soil resembled that in the bed of an ancient lake, and the impalpable dust raised its own crop of difficulties in the living and dark room problems.

Eclipse day, the 21st, was the finest day of all the 27 days the astronomers were at Wollai; and so it was also for the eclipse parties in Central and Eastern Australia. The only other eclipse station, that of the Greenwich astronomers on Christmas Island, had a cloud of sky and got no photographs; they had been on the island since early April.

Six officers and men of the navy assisted the eight members of the Lick observatory expedition. All of the California instruments worked perfectly and the program went through as planned. The observations were entirely photographic.

Efforts to develop the photographs at this station were made on two nights, but given up because of clouds of dust which even moderate breezes carried in to the tents.

While the reloading of the equipment of the schooner was in progress, after the eclipse, a genuine wind storm showed what the dust and waves could do. A delay of two and a half days ensued. After the wind died down the schooner was run in shore on the high tide nearly as far as it could. When the tide went out the schooner was high and dry on the beach, the loaded donkey wagons drove alongside and the remain-

ing three-quarters of the freight was on board in three hours. A small warship towed the schooner back to Broome, where the expeditions awaited the southbound steamer—not the Charon, which, true to tradition, carried its passengers only in one direction.

The four available days and nights in Broome were devoted to the development of the plates in an improvised dark room and to the beginnings of the accurate measurements of two of them. Before any measures could be completed, however, it was necessary to pack up and continue the journey. A hurried examination of the negatives showed them to be of great excellence in nearly all cases; the dust at Wollai had injured some of them pictorially, but not in their scientific qualities.

Director Campbell's original plans had provided time in Australia for the measure of several of the so-called Einstein plates, and the deduction of preliminary results, but the changes in the transport plans made by the Australian navy started the expedition north from Fremantle six days earlier and landed it again at Fremantle 15 days later than anticipated.

There was nothing to be done but pack the plates up finally at Broome for shipment home with the instruments. The glass plates and their packings weigh 600 pounds. The weekly steamer due to leave Fremantle two days after the shipment arrived there failed to run, and in consequence the instruments and plates did not reach Sydney in time to sail home with the astronomers. They are shipped instead via Tahiti, due to arrive early in December.

The four powerful Einstein cameras designed and constructed especially for the eclipse used plates 17 inches square and a quarter of an inch thick, of plate glass, weighing seven pounds each. There were 12 of these exposed during the period of total eclipse to record the faint stars surrounding the eclipsed sun. The one partially measured plate showed 82 such stars. The same number of plates were exposed with the instruments to the same group of stars in the night sky last May and June from the Island of Tahiti. A comparison of the two series of photographs of the same star group, one without the sun and the other with the sun in the center of the group, should show whether the sun influence displaced the star images of September 21 in the manner and extent specified by Einstein. This comparison will require several months of measurement and calculation.

The sun's corona was photographed at Wollai with a camera 40 feet in focal length, on plates 14x17 inches in size. The negatives are excellent, recording the details of the corona structure with great clearness. The Lick observatory lent a duplicate camera to the Adelaide university and observatory for use in Central Australia. The Adelaide negatives are likewise splendid. Copies of them will be sent to the Lick observatory, and it is hoped that a comparison of the Wollai and Adelaide photographs will tell us something about the changes and motions occurring in the coronal structure in the 35 minutes which elapsed between the making of the two series.

The five spectrographs devoted to the photography of the coronal spectrum performed perfectly in the hands of Dr. Moore. It is believed that studies of the photographs, based upon accurate measures, will add to existing knowledge concerning the chemistry and physics of the corona.

The governments, the educational in-

stitutions and the people of New Zealand and Australia were tremendously interested in the California expedition in its eclipse plans and in astronomy in general. Formal receptions with addresses of welcome were tendered by the mayors of all the cities through which it passed, by the universities in four capital cities, by the Royal societies of science, by the governor of one of the states, etc.

Formal luncheons were given by Prime Minister Hughes, Senator Pearce and the cabinet of the commonwealth government in the parliament house, Melbourne, and by Premier Mitchell, his cabinet and the entire legislature of Western Australia in Perth. Governors General Admiral Jellicoe, of New Zealand, and Lord Foster, of Australia, and the governors of three Australian states arranged to receive Director Campbell and his associates.

The standards of interest, hospitality and generosity set up by the governments and the people of Australia have probably never been equalled elsewhere on any similar occasion.

RAPA ISLAND OF EASE FOR MALES

But Women Not Too Anxious to Wed Men and Be Their Slaves

Honolulu, T. H. Dec. 11.—Overwhelming numerical superiority of females does not necessarily mean that the men are chased up hills and down dales by the females who outnumber them. There is the Island of Rapa, for instance in the Austral group in the South Pacific, about which some writer of frenzied fiction, in an endeavor to outnumber O'Brien redoubtable Fredrick himself, wove glittering narratives that made all previous tales of the South Seas evaporate into thin air by comparison.

Now comes the real truth about Rapa from the lips of J. F. G. Stokes, backed up by Mrs. Stokes, who went with her husband on a two year expedition to the Austral group in the interests of the Bishop Museum of Honolulu, where Dr. Stokes is ethnologist. Mr. and Mrs. Stokes have just returned to Honolulu.

Rapa is a land of laziness and ease for the men—says Dr. Stokes. The male population is for the most part, too lazy to live, and so there are four women to every man. Does the beautiful Rapa flapper get out her hatchet when she wants a beau and go after him with several others of her age, strength and inclinations? She does not!

The women of Rapa are not at all anxious to marry the men of their own race, says Dr. Stokes, as once they are married, they become little more than slaves. They have no hold or control over their husbands, who, despite the fact that each has only one official wife, never forget that each of them has three other possible candidates for

the official wife's position. A double standard prevails in Rapa, too, for if the official wife attempts the same privileges that her husband does she is liable to a severe "beating up," to say the least.

The people of Rapa—and this probably means the women especially—are exceedingly hospitable to white men. As a result of the recently published articles about the island and the ideal conditions there several white "beachcombers" have taken up headquarters on Rapa, much to the delight of the native women. Needless to remark Rapa is likely to become the South Pacific beachcombers' new paradise.

Although all the agriculture work and preparation of the food is done by the women, Dr. Stokes says that the stories that have been circulated of the actual feeding of the Rapa men by the women are true in only one respect

SELLS LAMB FOR PRICE OF WHOLE TON OF COAL

Nevada, Ohio, Dec. 11.—James Beam came to town with a commission to buy a ton of hard coal. He brought with him one lamb. He sold the lamb for sufficient money to pay for a ton of coal and received 1.25 cash in change. The coal cost \$15.

EXPORTS ARE IN EXCESS OF IMPORTS

Tokio, Dec. 11.—Japan's foreign trade during October amounted to 267,087,000 yen of which exports were 161,481,000 yen and imports 105,606,000 yen, showing an excess of exports over imports by 55,875,000 yen, according to the finance office. Compared with the trade of the corresponding period last year it shows an increase of 50,323,000 yen in the exports and a decrease of 24,564,000 yen in the imports. The increase of the export of silk contributed to this condition. The excess of exports trade over import amounting to more than fifty-five million yen is a record since October 1918.

Every pint of brandy a steady drinker takes shortens his life by 11 hours, and the average drinker he consumes curtails his earthly sojourn by 25 minutes, according to statistics compiled by scientists of Denmark.



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