



Indonesians and Australians at Mapala camp in the Meren Valley, in February 1972.

Ekspedisi Ilmiah Puncak Jayakesuma

James Peterson

On a glacier only four degrees from the equator, early this year Australian researchers and their Indonesian colleagues demonstrated, for the second time in twelve months, such a degree of co-operation at a working level as to justify hopes for even more closely integrated scientific activity along similar lines in the future. The following article (its Indonesian title means 'A Scientific Expedition to the Top of the Jaya Mountains') is by the leader of the 1973 Carstensz Glacier Expedition from Australia to Irian Jaya (West Irian): a geomorphologist from Monash University, Melbourne, he had been a member of the expedition's precursor, which was mounted at the turn of 1971/72. The photos are by Richard Muggleton, who was also with the earlier expedition.

Glaciology, meteorology, geomorphology, biology and surveying — these were some of the special interests of Australians taking part this year. They made their first stop in Irian Jaya at Jayapura, on the north coast, and then flew to Ilaga, a mountain village from which they undertook a tough sixty-mile hike to the glaciers. Among the Indonesians who joined in were officials of MAPALA-UI, the Student Naturalists' Society from the University of Indonesia.

THE GLACIERS of Irian Jaya (formerly West New Guinea), the only glaciers in Indonesia, are on the highest mountains between the Himalayas and the Andes. Until the first decades of this century they were still part of the 'last unknown'; in northern Europe, at least, geographical societies could be assured of a full house on those nights when the speaker was to talk about New Guinea.

The Snow Mountains of what was then, nominally at least, Dutch territory attracted special interest. To get to them involved an expedition across disease-ridden coastal swamps inhabited by hostile tribes, through thick forests in precipitous country often composed of jagged limestone dripping wet but lacking in surface water, and thence to the tree-line, the tundra, and the ice.

The largest ice fields in Irian Jaya are in what was then known as the Carstensz area. In 1623 Jan Carstensz, a Dutch navigator, sighted from the Arafura Sea the snow-capped peaks of the highest parts (Gunung Jayakesuma) of New Guinea's Central Cordillera, and reports of the tropical glaciers filtered through to Europeans growing ever more excited about far-away places and strange things.

All early attempts by Europeans to go to these ice fields were made from the south coast. In some ways, the choice was unfortunate. Deceptively close (about a hundred and twelve kilometres) to the landing places in the mangrove swamps, the glaciers were guarded beyond the labyrinth of coastal distributaries by swampy jungle, then rugged terrain cut by deep valleys, most of which ended in very steep cliffs that culminated in the crestral ridges of the cordillera.

The difficult nature of the country is indicated by the fact that Major Rawlings' British expedition of 1910-11 spent fifteen months along the Mimika River, saw the glaciers some one hundred times, but came nowhere near the ice. Persistent bad luck dogged the expedition. Although scientific results were achieved, they related only to lower country south of the ranges.

A. F. R. Wollaston, a member of this expedition, realised that success in exploring the ice field would be achieved by those who chose the river basin that led most directly into the high valleys with access to the glaciers. He returned to New Guinea and spent from September 1912 to April 1913 with a second expedition, this time in the valley of the Utakwa River. Most of the journey was made by canoe, the builders and guides being a group of seventy-four Dyaks; the supply line was maintained in the same way. (A younger relative of one of these Dyaks was to make the second ascent of the highest peak, Carstensz Pyramid, in 1972.)

In February 1913, Wollaston, his resources and

endurance completely extended, had to be content with reaching one of the precipitous southern ice margins, together with the botanist, Kloss.

More successful was the ascent of Mount Wilhelmina (Puncak Trikora) by a Dutch expedition of the same year. The geologist of that party, Dr. P. Hubrecht, again ascended the same snow-capped peak in 1921, this time from the north. Puncak Mandala was first ascended by a party of Dutch scientists in 1959, when it was known as Mount Juliana. The ice dome that covers its summit can be seen from Papua New Guinea.

The tropical ice masses in other parts of the world have been shown to be diminishing, and the results of the recent Indonesian and Australian Carstensz Glaciers Expedition show that the same is true of the tropical ice of New Guinea.

The main (valley) glaciers of the ice fields

Michael Rumbiak, Lecturer in Geography at Unchen University, Jayapura, points out features of lamination in lake deposits over-ridden by neoglacial deposits.





At Unchen University, Richard Muggleton, photographer for the Australians, talks with English language students.

have retreated more than two kilometres over the last hundred years or so. Since first visited in 1936, the Meren Glacier has retreated about 1,430 metres.

It is possible to make such a statement because the Dutch geologist, J. J. Dozy, now professor at the Technical University of Delft, thoughtfully placed a cairn at a known distance from the ice front. His party was the first to climb the ice domes around the Nordwand Firn, having used a seaplane to help choose a suitable route from the south coast which led them directly to the Meren Valley. Between then and Heinrich Harrer's expedition in 1962 the

three domes along the Idenberg Ridge had been reduced to one, that of the Idenberg top itself. Photographs of the summit of Puncak Mandala show that ice retreat has occurred, and a visit to Puncak Trikora by a missionary in the late 1950s showed that the ice mass described and photographed by Hubrecht had disappeared entirely.

This retreat, known in other parts of the world, follows the last of a series of minor glacial advances that have been the general pattern for mountain glaciers since the end of the 'warm interval' about five thousand years ago. These are known as the neoglacials, in contradistinction to the major climatic deteriorations accompanying extensive glacial actions that have characterised the last few million years of the earth's history. On the geological time scale these climatic changes were large, violent and frequent.

Among the terrestrial, geological evidence for this sequence of events, that indicating the changes in ice extent is often readily interpreted. The glacial evidence in tropical areas is not particularly extensive, and the scientifically little explored mountains of Irian Jaya are something of a magnet to scientists studying the modern atmosphere and its relationship with the health of modern glaciers, as well as to those curious to find out the sequence and magnitude of climatic changes of the past.

During the build-up of the great ice age glaciers that covered large areas of North America, Europe and parts of Eurasia, world sea levels fell at least ninety metres. In consequence, the Arafura Sea, Carpentaria and Torres Strait areas were dry, and there was a broad land bridge between Australia and New Guinea. It is probable that during the period of maximum cold the glaciers were starved of snow, because the south-westerlies from the northern Australian region would not have passed over warm tropical seas before rising across the Central Cordillera.

Damil tribesmen build a temporary foot-bridge across a stream on the mountain slopes.





ABOVE: The northern scarp of the glacier-covered Jaya Mountains towers above *Cyathea* grassland and wooded moraines of the Kemabu Plateau. RIGHT: Dani tribesmen at Ilaga grow sweet potatoes and other vegetables and keep pigs. The elevation is about 2,300 metres.

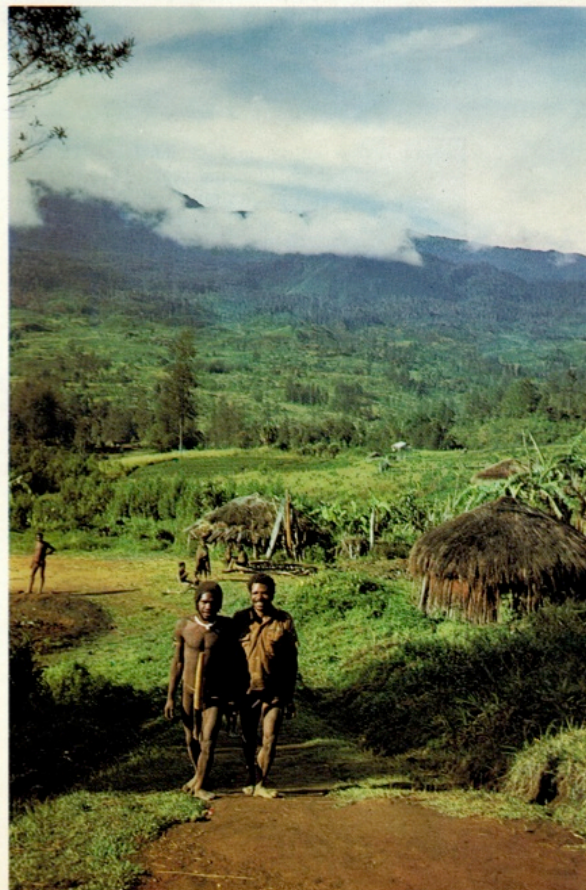
Ten thousand years ago, when the ice age was ending and sea levels continued to rise as a result of the melting of the northern hemisphere ice caps, there was a major advance of the glaciers. It was short-lived, and was probably the result of sudden increases in precipitation in response to the flooding of the Arafura Shelf region.

The earlier neoglacial advances and the warm period that preceded them and followed the end of the ice age are reflected too. The warm period, known as the hypsithermal, probably saw the disappearance of the ice bodies of Irian Jaya.

The tree-line was probably higher, because the remains of animals now much more plentiful at lower elevations were found in what is taken to be the 'kitchen' of a rock shelter at about four thousand metres. Some of the remains were radiocarbonated as being about five thousand years old.

The bone and charcoal layers were overlain by deposits that contain no evidence of human activity.

The bones were cracked open in the eating, in a way uncharacteristic of the present highlanders. Were these earlier inhabitants a different people? Will the prehistoric archaeology of deposits such as these shed light on the coming of man to the Australian continent?





Accumulation stakes were placed on upper parts of the main glacier.

Man is now known to have inhabited Australia for more than thirty thousand years. But the links between early man in Australia and the migrations of people in the areas adjacent to the north is a matter for future co-operative study by scientists of Indonesia, Papua New Guinea, and Australia.

Investigations will rely not only on site excavations but also upon the vegetation history of the area, now being progressively written up region by region at the Australian National University. This history is based on the analysis of fossil pollen grains from bogs and swamp deposits. Cores from post-glacial swamps in the Puncak Jaya were collected by both the 1971-72 and 1973 expeditions as part of this programme.

The postulated warm period was followed by the neoglacial advances, evidence for which is well preserved in a sequence of soils and lake deposits buried by debris laid down by over-riding ice. Dating of the soil materials gives a maximum age for the glacial advances of two thousand four hundred to two thousand nine hundred years, corresponding to the second major neoglacial period.

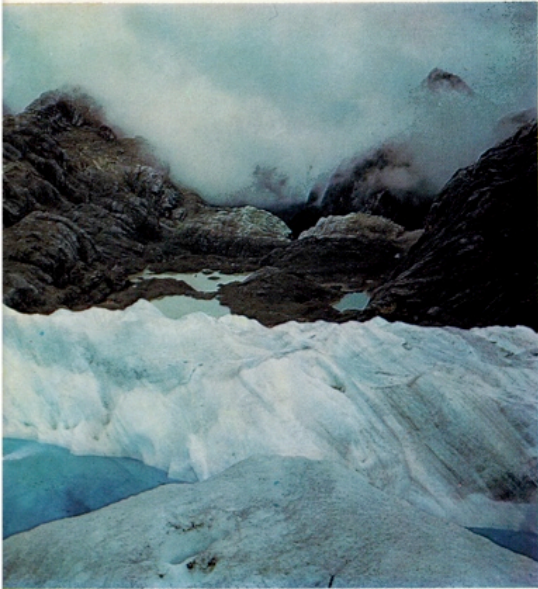
The retreat of ice from the third neoglacial period has already been mentioned. The negative glacier mass balance implied is probably due to a warming

of the earth's climate, rather than directly to changes in the amount of snow precipitation.

This general warming, indicated by data from many different sources, is of great interest to atmospheric scientists, the major concern being elucidation of the extent to which increased and man-induced carbon dioxide and dust content of the atmosphere is responsible. Therefore, there is a need to keep track of the climatic changes in as many parts of the atmospheric 'heat engine' as possible, and data from such high, remote, tropical locations as the Jaya Mountains is a major filler of gaps in our knowledge.

Studies of the present environment included mapping, vegetation and faunal surveys, recordings of ice temperature and movements, and examination of the prolific cryo-vegetation on parts of the melting tongues of the main valley glaciers and the related 'coloured snows' above them. Weather records were gathered, and routine collections of plankton from the lakes and bird skeletons from the glacier were made.

The more adventurous side of the expedition included treks across the Kemabu Plateau and ascents of some major peaks of the Jaya Mountains. For instance, the second expedition spent eight days



Algal colonies absorb sunlight and melt lakes into the ice.



A cairn left near the ice front in 1936. The ice has since retreated.

The route across New Zealand pass is often powdered with snow.





ABOVE: Dani youngsters, curious about the expedition but wary of coming too close. BELOW: A Dani elder poses with officials near the Ilaga school house.



walking more than ninety-five kilometres from Ilaga (2,286 metres) south and west to the high valleys in which base camp was established at 4,250 metres.

Some thirty western Dani men from the Ilaga, led by their preacher, Georit Wanimbo, were porters for the expedition, which followed one of the local routes across the mountains — as did the first post-war expeditions before ours. These were climbing expeditions intent on claiming hitherto unclimbed peaks of the Dugundugu, as it is known around Ilaga or, as it is just as often referred to now in the very effective lingua franca, Bahasa Indonesia, *Gunung Es* (Ice Mountain).

Most of the locally used routes do not cross the height of land near the ice fields but use lower passes to the east and west. Since the visits of the mountaineers, however, the way up Discovery Valley to Lakes Larsen and Dugundugu and then up and

over a pass in the great north face of the Jaya Massif has become known to both western Dani and their Damil and Amume neighbours alike.

The routes start among some of the highest sweet potato gardens and climb through the mountain rain forest to the limestone plateau country with *Cyathea* grassland and, higher up, well marked moraine ridges clothed in low trees and shrubs. On the plateau there, densely fluted and jagged limestone thrusts up from a now vegetated superficial layer of glacial debris. These outcrops escaped being completely plastered by moraine deposits during a glacial advance. Subsequent exposure to the atmosphere has caused their surfaces to be dissolved into fantastic, sharp-edged, solution-weathering forms that make a startling contribution to the mood of the landscape.

The main peaks of the Jaya Mountains include the very highest, named the Carstensz Pyramid on earlier maps and currently called Puncak Jaya-kesuma. It was first climbed in 1962 by Heinrich Harrer, who wrote *Seven Years in Tibet*. Since then, a party from the Student Naturalists' Society of the University of Indonesia (MAPALA-UI) and a party from the Hong Kong Mountaineering Club have made the climb.

Opinion differed concerning the height of the peak. A survey marker was placed on the summit by the expedition's surveyor, Ted Anderson, of the University of New South Wales, and myself; the elevation was found to be 4,884 metres, after intersections were made from other points established by triangulation from a base set by a south coast mining company.

Other peaks in the area were also surveyed: Ngga Pulu is 4,860 metres, and the Idenburg top is 4,650 metres. Although not as high as more famous glaciated mountains elsewhere, they are high enough to require climbers to be acclimatised. In future they are likely to attract the attention not only of Indonesian climbers from MAPALA, Jakarta, and Unchen University in Jayapura, but many others as well.

To me, however, the scientific interest is paramount. There is much potential for mutually beneficial endeavour, with scientific expeditionary teams composed of Indonesian and Australian members, and participation, perhaps, from Papua New Guinea. Many interesting and significant questions are awaiting investigation and offer a wonderful opportunity for young field workers to practise scientific investigation and exploration in the spirit of international goodwill.

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