In the Footsteps of Mackinder

NIGEL C GATES

(*Plates 69–73*)

Mount Kenya was first climbed in 1899 by Sir Halford John Mackinder, 'the father of British geography', with César Ollier and Joseph Brocherel, both from Courmayeur. As a geographer and mountaineer I had long wished to follow in Mackinder's footsteps. Therefore I was delighted when Lieutenant Steve Jackson of the Royal Navy & Royal Marines Mountaineering Club (RNRMMC) offered me a place on his expedition to Mount Kenya and Kilimanjaro. The aims of the RNRMMC expedition were to carry out both medical research and mountaineering in East Africa during January and February 1987.

Mackinder, the first lecturer appointed specifically to a post in geography at a British university, became Reader in Geography at Oxford University in October 1887. Because, as he stated, 'at that time most people would have no use for a geographer who was not an adventurer and explorer', he organized an expedition to East Africa in 1899 with Campbell Hausburg. Mackinder's ship left Marseilles on 10 June and reached Zanzibar on 28 June. He proceeded to Kenya, then part of British East Africa, then travelled on the newly-completed railway from Mombasa to Nairobi. Today one normally flies non-stop between Europe and Nairobi overnight. Mackinder's 170-strong expedition, comprising six Europeans, two Masai, 66 Swahili and 96 Kikuyu, left the Nairobi area on 26 July. They made the overland journey, then slow and difficult, to the base of Mount Kenya on foot during the heavy summer rains and arrived some three weeks later, on 15 August. In 1899 few man-made tracks existed on Mount Kenya, and Mackinder's party had to force a route – which his Italian guides called *la grande route du Mount Kenya* – through the belt of dense bamboo and forest which cloaks the lower slopes of the mountain. Although Mackinder expected this to take three days, it was actually accomplished in a single day. Today one normally drives from Nairobi to the Meteorological Station (3048m), near the top of Mount Kenya's forest belt, in a few hours.

Mackinder's expedition utilized a large number of porters. However, as his description demonstrates, this was not without problems. Not only had Mackinder's expedition to contend with stores theft, porter mutiny and porter desertion; two Swahili porters were actually killed in an attack by hostile Kikuyu tribesmen. Many Kikuyu now work as porters on Mount Kenya and porterage is a thriving and lucrative business. The RNRMMC expedition, with large quantities of equipment and stores to move up the mountain, employed 70 Kikuyu porters. However, we soon discovered that each porter will only carry a maximum of 18kg and has to be paid four days' wages for just one day's work. In addition to the entry fee and daily charges that all mountaineers must now pay to the Mount Kenya National Park authorities, one must also pay similar

fees for each porter employed. In 1899 Mackinder did not experience these particular bureaucratic problems.

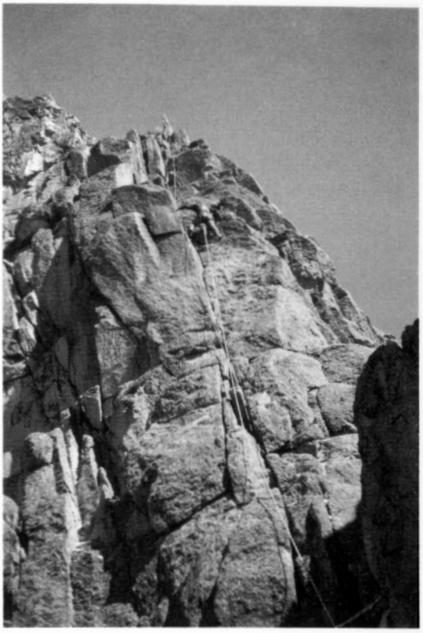
From the top of the forest belt, Mackinder's expedition reconnoitred its way up the mountain to a position roughly half-way between the mountain's base and the foot of the central peaks, and standing camp was made at 3139m. On 22 August the site of the highest camp was chosen; this was in the Teleki valley, probably very close to the position now termed 'Mackinder's Camp' (4328m). Unfortunately, because of a smallpox epidemic which Mackinder encountered on arrival in Zanzibar, which had forced a precipitous departure from Nairobi, the expedition had been mainly unable to purchase stores and was forced to live on what the land could provide. Although the mountain party had food supplies for about three weeks, the Base Camp below the forest belt was nearly devoid of supplies, and Mackinder descended the mountain on 24 August to return to the camp. The personnel were dispatched to cross the then unexplored Aberdare Range to buy food at a Government station on Lake Naivasha, and Mackinder and Hausburg reascended the mountain on 26 August.

On 30 August, Mackinder and the two Italians made their first attempt to climb to the summit. They climbed the eastern face of the southern arête but were delayed by various difficulties and, caught high on the mountain by nightfall which occurs early in the tropics, were forced to spend the 12-hour equatorial night in an unplanned bivouac at 5121m. Next day they continued up the arête but were eventually stopped by an impassable difficulty, and the first attempt was abandoned.

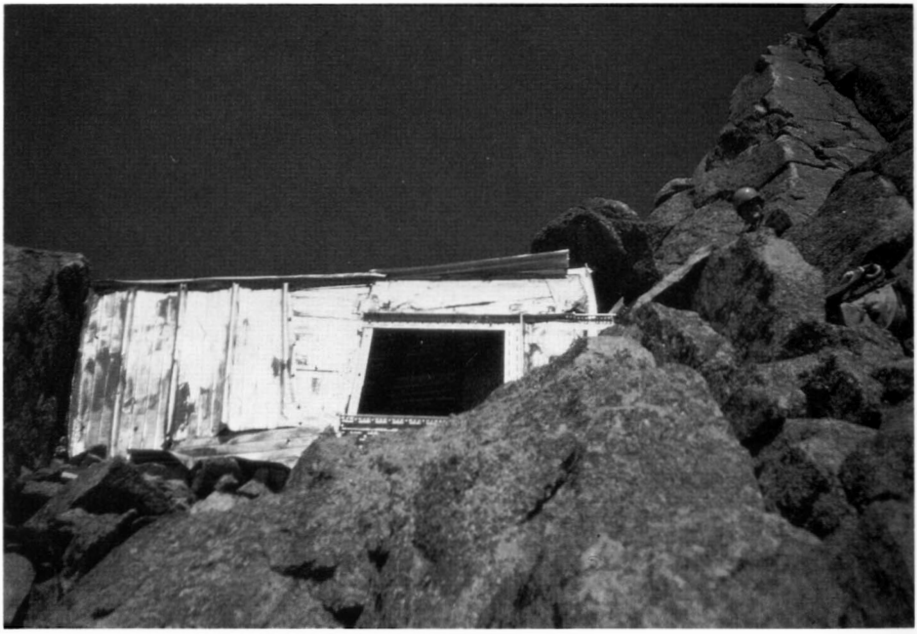
Mackinder then left the mountain to watch for the return of the party he had sent to Naivasha, while Hausburg and the Italians made a traverse around Mount Kenya's central peaks to see if they could spot an easier route to the summit. They did not find one, so Hausburg and Ollier attempted to climb the mountain by cutting their way up the Darwin glacier. However, stopped by bad weather and unable to climb higher or to retreat the way they had come, they were lucky in being able to traverse to the S arête and descend the route followed earlier by Mackinder. By 5 September the Naivasha party had still not returned, and the food supply situation was getting desperate. Mackinder sent word for all to descend to Base Camp so that they could themselves depart for Naivasha on 7 September. Thus it was indeed fortunate that the Naivasha party returned on 7 September with supplies of food.

Mackinder returned to the mountain to make a final attempt to reach the summit. On 12 September, he and the two Italians again followed the now familiar route up the face of the southern arête. However, this time they spent the night inside a Mummery tent near the top of the arête. Early next morning they left the arête, traversed across the head of the Darwin glacier and then followed a rock-rib to a glacier which descends from the Gate of the Mist, the high col between Mount Kenya's twin summits of Batian (5199m) and Nelion (5188m) – all names given by Mackinder. They had hoped to cut steps in this glacier and traverse it in 20 minutes, but the glacier proved very steep and its ice was intensely hard. Step-cutting was extremely arduous, the traverse took three hours and Mackinder named this adamantine glacier the Diamond Glacier.

69. *Sir Halford Mackinder (1861–1947).* (p 154)



70. *At de Graaf's Variation, the crux pitch (IV–) of the normal route up Nelion. Climber: Jim Milledge.* (p 154)



71. *Approaching Baillie's Bivi near the crest of the southern arête on the normal route up Nelion. It is probably close to this point that, in 1899, Mackinder and his two Italian companions spent the night in their Mummery tent.* (p 154)

From the Gate of the Mist a final rock scramble took Mackinder, Ollier and Brocherel to the summit of Batian, which they reached precisely at noon on 13 September. They stayed on the summit for about 40 minutes and then, in mist, descended cautiously by the same route. The lower section of the descent was completed in darkness and the three finally reached camp after 10pm, 'exhausted, but victorious'. Mackinder remained on Mount Kenya for several more days before descending to Base Camp on 20 September. While on the mountain the expedition also undertook scientific experiments and other research; this included altitude studies, botany, cartography, geology, glacier surveys, meteorology, photography and zoology. Mackinder left Mount Kenya on 21 September and arrived back in London on 30 October.

Reading Mackinder's account of the expedition in the *Geographical Journal* of the year 1900, one cannot fail to be impressed by the dynamism and personality of this quite remarkable British Victorian geographer. In fact, Mackinder did not climb Mount Kenya by its easiest route. Mackinder's Route (now graded IV) diverges from today's normal route (pioneered by Shipton and Wyn Harris in 1929 and graded IV Inferior) at the half-way point, and then follows an exposed ascending line across steep rock and ice. The glaciers are shrinking fast on Mount Kenya and, in 1899, Mackinder's route may have been somewhat easier than it is today, as there may well have been more snow and ice than rock. There are now two tiny bivouac huts which climbers on the normal route can utilize if necessary; one is near the top of the S arête, probably at the position where Mackinder spent the night in his tent, and the other is beside Nelion's summit. However, even today Mount Kenya still remains a 'mountaineers' mountain'. It is not to be attempted lightly and there are many serious routes on the mountain, such as the famous Diamond Couloir. There are no easy routes up and down Mount Kenya and, having climbed it myself, I can only applaud Mackinder's incredibly bold first ascent. His 1899 climb was quite outstanding. Although many now attempt the ascent of Point Lenana, Mount Kenya's third highest summit (4985m) which does not demand climbing skills, the walking circuit around Mount Kenya's central peaks – first followed by Hausburg and the Italian guides – is not walked by many but is certainly well worth following. I walked it comfortably in eight hours and Steve Bell, our Royal Marine, ran it in under three hours.

Mount Kenya, an extinct volcano with a central core consisting of syenite on which 15 small glaciers exist, literally straddles the equator. However, we soon discovered that Mount Kenya's weather was not typically equatorial; each day started cold and clear, but by mid-morning clouds usually covered the sky and it frequently rained, hailed or snowed. Equatorial climates are normally without distinct seasons but, surprisingly, this does not apply to Mount Kenya. In January and February the northern side of the mountain has a winter season while the southern side has a summer season; in August and September these positions are reversed. The unusual combination of high altitude and equatorial latitude has resulted in quite incredible vegetation, such as the Giant Heather, Giant Groundsels and Giant Lobelias, all of which Mackinder noted in 1899. These are among the most spectacular of all mountain plants. Some lobelias grow to eight metres, while another variety forms a giant rosette close to the

ground filled with water containing pectin which reduces evaporation and inhibits freezing. The rock hyrax found on Mount Kenya, small animals surprisingly related to elephants, supposedly eat lobelia but they also find mountaineers' rations very attractive!

On the RNRMMC expedition, a main aim was medical research into Acute Mountain Sickness (AMS) which was carried out under the personal direction of Surgeon-Captain Michael Beeley and Dr Jim Milledge, both experts in high-altitude physiology and medicine. By normal expedition standards the medical input to the RNRMMC expedition was very high-powered; there were four doctors, two paramedics and one nurse. Eight medical research protocols involving many separate tests were involved, and all 22 members of the expedition, including the seven 'medics', provided data as subjects. Many mountaineers experience AMS problems associated with ascent to altitude. AMS can be mild or severe, and can take several forms such as headache, nausea, sleep disturbance and loss of appetite. In particularly severe cases, death can occur with great rapidity from pulmonary or cerebral oedema. Many of the reasons for AMS are not yet fully understood, and a major aim of the RNRMMC expedition was to gather medical data, take blood and urine samples and undertake other medical tests on the expedition members at various altitudes. No RNRMMC expedition members used Diamox, as its use would have negated our research protocols.

The amount, although not the actual proportion, of atmospheric oxygen decreases with increasing altitude, and this lack of oxygen is the root cause of AMS. The accepted way to avoid or minimize the symptoms is by acclimatization, and this is best achieved through a leisurely ascent to altitude. Surprisingly, Mackinder's expedition report does not mention symptoms of AMS, and it is therefore likely that acclimatization took place on the long slow walk from Nairobi to the top camp on Mount Kenya. Long-term acclimatization is achieved because the bone-marrow produces additional red blood cells in response to oxygen lack. This process is slow; the body's red blood cell count has only increased by about 10% after ten days, and it takes about six weeks to achieve the maximum increase of about 30%. However, the modern medical view is that increased haemoglobin is not an important aspect of acclimatization; other factors and mechanisms are also involved in the process, particularly in the short term. The main process of acclimatization is the change in the control of breathing. As one ascends, and the amount of atmospheric oxygen decreases, one becomes more sensitive to carbon dioxide; this results in increased ventilation. Several hormones are believed to be involved in the body's response to altitude: renin (produced in the kidneys), aldosterone (produced in the suprarenal glands), and atrial natriuretic peptide (produced in the heart). Ascent to altitude may result in fluid retention or loss, and it has been said that those who get AMS tend to retain fluid, while those resistant to AMS have increased urine output. There have therefore been a number of studies of aldosterone, which causes salt (and water) retention. However, the newly-discovered hormone atrial natriuretic peptide had not (until the RNRMMC expedition) been studied at altitude.

Mount Kenya is an excellent location for medical research into AMS

because mountaineers usually drive straight to the Meteorological Station and then make the ascent to Mackinder's Camp in a single day's walk. This ascent of 4328m is extremely rapid by mountaineering standards and symptoms of AMS are, therefore, very common on Mount Kenya. Half the world's annual cases of pulmonary and cerebral oedema are reputed to occur there!

Since all the medical protocols were related to AMS, the recognition and scoring of its symptoms was crucial. For the first six days at Mackinder's Camp, all expedition members were questioned in detail about their AMS symptoms and their responses were recorded. Headache, loss of appetite, nausea, sleep disturbance, Cheyne-Stokes breathing and photophobia symptoms were scored each morning on a scale ranging from no symptoms to severe symptoms. Two subjects were virtually unaffected by AMS. Another member was so sick that he required rapid evacuation to low altitude; after a few days at 2000m, however, he recovered and rejoined the expedition with no ill effects. Few members experienced any Cheyne-Stokes breathing or photophobia, but I observed that over half the expedition members experienced definite signs of the remaining four AMS symptoms. Thus, as far as our AMS scores were concerned, we had a good spread of severity of AMS against which other medical observations could be compared.

Before leaving the United Kingdom, all expedition members attended the Lung Function Laboratory at Northwick Park Hospital where our routine pulmonary functions and our ventilatory responses to both hypoxia (oxygen lack) and carbon dioxide were measured. Publication of results showing any correlation between the hypoxia and carbon dioxide ventilatory responses and the AMS symptoms which members experienced on Mount Kenya is still awaited.

Haemorrhagic phenomena in various organs, including the eye, are known to occur on exposure to altitude, and it has been suggested that these might be related to AMS. We tested capillary fragility, using the technique of mucosal petechiometry where suction is applied to the inner surface of the lower lip for one minute. This process causes a few petechiae (pinhead-size haemorrhages) which are then counted. Base levels of the subjects' petechiae were established in Nairobi, and the process was again carried out at Mackinder's Camp. The expedition hoped to relate petechiae scores to AMS. However, the results show that there was actually a decrease in petechiae, and there was no correlation between petechiae scores and AMS.

The most unpleasant aspect of the medical tests involved giving frequent blood samples. Blood was drawn from our veins and spun for 20 minutes in a hand centrifuge to separate the blood into plasma and red cells. This was undertaken to measure plasma volume increase relating to altitude from measurements of haematocrit (the ratio of the volume of red cells to the total volume of a blood sample) and haemoglobin (the chemical in the red blood cells which combines with oxygen). Sampling was carried out on two days at Nairobi to establish subjects' base levels, and again for two days on arrival at Mackinder's Camp. Blood pressures were also measured daily. Plasma volume change was inferred from the haematocrit increase assuming a constant red cell mass, an assumption probably valid over the short period during which the

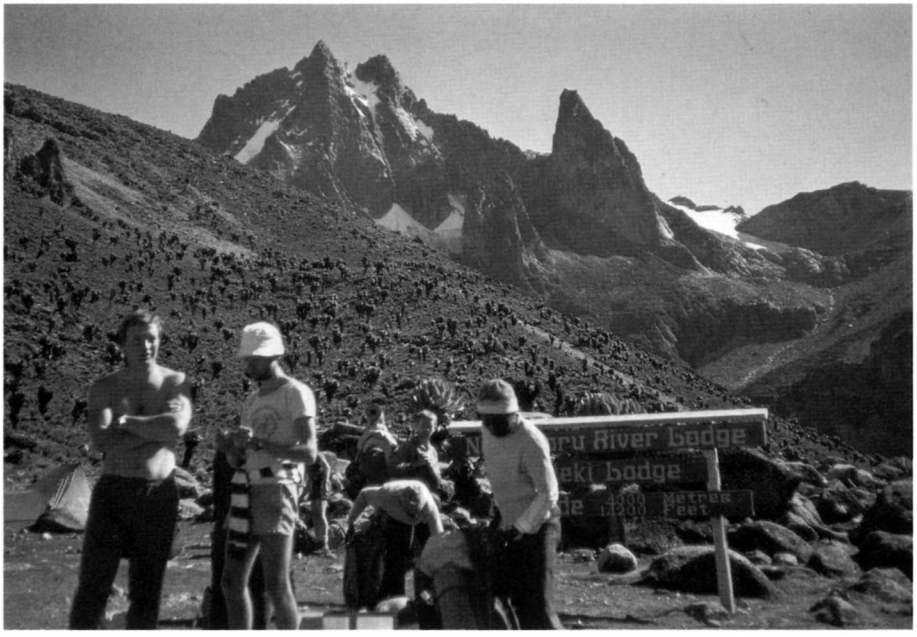
blood samples were taken. In an attempt to study the effect of posture, samples were taken at 4am and compared with samples taken at 9am when subjects had been up and about for at least an hour. As expected, haematocrit rose in the group as a whole. However, the final results show no correlation between individuals' AMS scores and changes in their plasma volume, haemoglobin and haematocrit.

Symptoms of AMS have been reported to correlate with water retention. To examine this, each member's weight and urine output was recorded daily; this commenced in Nairobi. All urine passed by each individual in 24 hours was collected, and this meant that one's personal 'pee-bottle' had to be within easy reach at all times. As expected, on ascent to altitude, and following a fairly strenuous day's walking from the Meteorological Station to Mackinder's Camp, urine outputs were diminished. The final results show no correlation between individuals' AMS scores and urine volume. There was, however, a significant negative correlation with individuals' 24-hour urine sodium output. No correlation was found between AMS scores and changes in body weight.

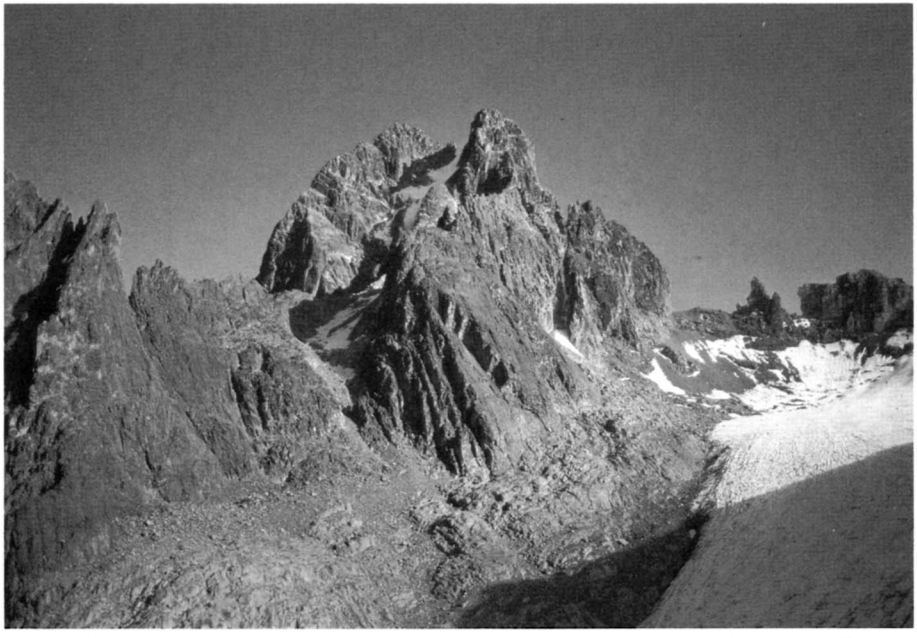
AMS is thought to be related to the body's fluid balance, and another reason for taking blood samples was to analyse the changing levels of aldosterone and atrial natriuretic peptide. These hormones are believed to be important in regulating sodium excretion and are thus related to the body's fluid balance. Each sample of the subjects' blood was centrifuged. The resulting plasma was marked with date and time, preserved by freezing in a cryostat containing liquid nitrogen and solid carbon dioxide, and returned to the United Kingdom for analysis. Most expedition members gave their blood at 4am and 9am but a small and dedicated subset of five gave their blood four times a day, at 4am, 9am, 4pm and 9pm, in order to provide more detailed data on the body's circadian rhythm and hormone release cycles. Small samples of each member's daily urine output were also dated and frozen in the cryostat, so that an individual's sodium output could be isolated and measured. The process to assay the hormones is sophisticated and tedious and the many samples of frozen plasma and urine took considerable time to analyse. The final results show a significant correlation with aldosterone, and a negative correlation with atrial natriuretic peptide, on arrival at altitude. However, most unexpectedly, the Nairobi atrial natriuretic peptide value seemed to be predictive of AMS; subjects with high values had little AMS and vice versa.

The final test undertaken by the expedition was concerned with the treatment of AMS headache. This was a trial between Ibuprofen (Brufen) and paracetamol. The test was carefully controlled, and subjects never knew which of the two drugs they were taking; they merely took a tablet and scored the headache's severity after 30, 60 and 120 minutes. If the headache was unresolved a second, different, tablet was taken, and the same scoring process was again followed. The trial's findings have still to be published. However, on completion of the medical research, when we could freely take analgesic drugs, many expedition members discovered empirically that they got good relief from their AMS headaches after taking Brufen (usually prescribed for rheumatoid arthritis).

After completion of our medical research and mountaineering on Mount



72. At Mackinder's Camp with Mount Kenya in the background, showing (L to R) Batian (5199m), the Gate of the Mist, Nelion (5188m), Point John (4883m) and Point Lenana (4985m). (pp 154, 162)



73. The central peaks of Mount Kenya seen from the S across the Lewis glacier. The normal route up Nelion ascends the face below the southern arête until the arête is reached. (pp 154, 162)

Kenya, the RNRMMC expedition moved to Kilimanjaro. For anyone thinking of climbing Kilimanjaro, let me immediately point out that it has now become prohibitively expensive; it cost us about £500 each for our six-day trip, starting and finishing in Nairobi! The Tanzanian and Kilimanjaro National Park authorities appear to make as much money as they can out of Kilimanjaro; certainly the people we saw on the mountain seemed to be mostly affluent Germans and North Americans. The genuine mountaineer will probably baulk at paying the considerable sums now being demanded for visas, Kilimanjaro National Park entrance fees, guides' fees, porters' fees and hut fees, and I fear that the Tanzanians may well be rapidly killing the goose which lays their golden eggs. Nevertheless, I greatly enjoyed my quick trip to Uhuru Peak (5986m), the main summit of Kilimanjaro, by the Marangu route (the normal tourist route via the Mandara, Horombo and Kibo huts). Having spent almost three weeks at altitude on Mount Kenya, we naturally thought that we were well acclimatized. However, many of us still found the final 600m of ascent quite tough going. Although many people start the ascent of Kilimanjaro, a substantial proportion never reach the summit; many give up on the seemingly never-ending scree leading to Gillman's Point, the subsidiary summit on the crater rim at 5681m. Although many members of the RNRMMC expedition ascended Kilimanjaro by much more difficult ice-climbing routes, such as the Heim glacier route, it does need stressing that the Kilimanjaro National Park authorities actively discourage deviation from the Marangu route. Those wishing to climb the mountain by other routes must pay substantially more in fees.

The RNRMMC expedition was very successful. The insights into AMS will hopefully advance our understanding of acute mountain sickness. Personally, I was very pleased to have walked and climbed in the footsteps of Mackinder but, I wonder, did he also return to England suffering from amoebic dysentery?

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REFERENCES

I Allan, *Guide to Mount Kenya and Kilimanjaro.* Mountain Club of Kenya, 1981.

F Benuzzi, *No picnic on Mount Kenya.* Kimber, 1952.

H Lange, *Kilimanjaro: the white roof of Africa.* Mountaineers, 1985.

H J Mackinder, 'A journey to the summit of Mount Kenya, British East Africa.' *Geographical Journal XV,* 453–487, 1900.

J S Milledge, J R Broome and J M Beeley, 'Microvascular fragility and acute mountain sickness.' *British Medical Journal 296,* 610, 1988.

J S Milledge, P S Thomas, J M Beeley and J S C English, 'Hypoxic Ventilatory

Response and Acute Mountain Sickness.' *European Respiratory Journal I*, 948–951, 1988.

P Robson, *Mountains of Kenya*. East African Publishing House for Mountain Club of Kenya, 1969.