fatigue cracks that might have been present initially. Undoubtedly ice-axes have been broken on many previous occasions on the N face, but this party does seem to have sustained a particularly high failure rate of very vital pieces of equipment, being reduced eventually to 5 axes among 6 climbers. One assumes that this was an above-average failure rate—we would be glad to hear of the experiences of other parties in analogous situations.

Labelling system for British made-up textile products Many of the tents and garments now arriving in increasing numbers from E Asia are said to be made from materials degradable by sunlight. Tent walls and groundsheets are permeable and general construction unsatisfactory. Moreover in most cases there is no redress from the retailer or reference back to the manufacturer. Tent and awning manufacturers in this country who are members of the Made-up Textiles Association (MUTA) have decided to promote their British-made products with an approved symbol so that the public will know when they are buying a reliable item. This mark will eventually appear on all tents, sleeping bags and other textile camping products manufactured in Great Britain by approved suppliers. Quality assurance will be provided through the Association, which will deal impartially with all customer disputes.

The large tent-making industry in France is said to have collapsed almost completely during the last few years; urgent action is needed from all of us to prevent the same fate overtaking Britain's manufacturers.

Science Notes 1979

Tom Connor and Edward Pyatt

Santorini 'In the late Bronze Age sometime between 1500 and 1450 BC a paroxysmal explosive eruption of the volcano Santorini took place in the Aegean Sea. Many scientists now link the rapid decline of the Minoan Civilisation centred on Crete with destructive effects of this catastrophic eruption. The geological record indicates that one or two eruptions of comparable magnitude may occur every thousand years. In our present-day world with its rapidly expanding population and economy the catastrophic effect of such an eruption occurring today should be seriously considered'. The above is a summary of a paper by R. S. J. Sparks in *Endeavour*, 1979. In the last decade the site of Akrotiri on Santorini, buried and preserved beneath volcanic ash ejected at the eruption, has been excavated and much new light thrown on this subject.

The caldera formed by the collapse of the volcano after eruption measured 8 × 11km and is 8m deep. The eruption was a Plinian type and perhaps as much as 50km^3 of material (compared with 5km^3 from Krakatoa) was ejected. Tsunamis (tidal waves) were almost certainly generated which would have had a devastating effect on shipping along the N coast of Crete, while it is probable that water, fed into the atmosphere when sea water entered the magma chamber, fell in catastrophic rain storms.

There have been some historical eruptions worse than Santorini. 30,000 years ago there was 140km^3 of ejection from an eruption near the Bay of Naples, forming a layer tens of metres thick over 6000km^2 of S Italy. The greatest-known occurred on Sumatra 75,000 years ago when 1000km^3 of magma were ejected in 2 weeks—the largest volcanic crater in the world, the Toba caldera, was formed measuring 35 × 100km.

An eruption even on the scale of Santorini would have serious effects today, particularly if it occurred near a big food-producing area. There might also be serious short-term effects on global climate (Krakatoa caused 0·5°C temperature drops for 2 years).

Mount Etna Whereas Santorini made the news many hundreds of years BC, Etna is still doing so today, although fortunately in a less-spectacular way. However, 1979 was a bad year for those living near the mountain. An eruption in August/July destroyed a number of farmhouses and many acres of vineyards and threatened the nearby village of Fornazzo: on 12 September, 9 tourists were killed by a sudden explosion at the Bocca Nuova crater which had been dormant for many years. Etna has had an eventful record of recent activity (the last eruption was in 1971 and there was activity in 1965 and 1956) and a significant characteristic is the continual change in configuration of the craters over the years. New craters appear from time

to time, are active for a decade or so, and then disappear as the result of some new upheaval. James Brander, writing in *New Scientist* (18 October 1979) ascribes this pattern of activity to the fact that Etna has been formed at a position where a number of crustal fault lines meet—craters tend to form along these lines or at their intersections. Routes for magma flow opened at one occasion become blocked and are subsequently replaced by nearby alternatives through the many fissures created by the complex of faults. It may be that the existence of a variety of points at which pressure of magma can be relieved has prevented the occurrence of a Plinian type of eruption described in the case of Santorini. The existence of these faults in Sicily and S Italy can be explained in terms of plate tectonics at a local level, that is in this case the drift of the African plate into the European. This is already thought to be the cause of the formation of the Pyrenees and the Alps, and it is conjectured that the Mediterranean Sea will ultimately disappear and the continents become joined. It seems likely that the area around Etna is a small-scale subduction zone, ie one where the relatively thin crust of the sea floor is being pushed down into the Earth's interior.

Iceland's volcanoes Iceland lies on the Mid-Atlantic Ridge, a chain of undersea mountains which runs N to S in the Atlantic Ocean. Again, the theories of plate tectonics see this ridge as a so-called accretion boundary where new crustal material is formed by volcanic activity, pushing the 2 plates apart in the process. These boundaries are thus the obverse of the subduction zones mentioned above, where plate edges are being pushed back down into the Earth's crust again. Volcanic activity in Iceland occurs along this boundary between the plates and James Brander, in another *New Scientist* article (14 June 1979), discusses some recent events in the Krafla volcanic centre in N Iceland which seems to throw some light on a possible mechanism by which the plates grow apart. A new period of activity began here in 1975 and followed a long while after the previous occasion which was in 1724, and was well documented as the 'Myvatn Fires'. The eruptions themselves were not severe, but were accompanied by long periods of seismic activity which travelled N and S from the volcanic region along the faults associated with the axis of the Mid- Atlantic Ridge. It was discovered that 2 large chambers are situated in the crust below Krafla, each containing magma which gradually accumulated during the quiet period between 1724 and the present day. It is thought that chambers gradually fill, raising the floor of the Krafla caldera by 2·5m, and then, having reached a certain level, subside. The subsidence produces the bursts of seismic activity observed and it is believed that the magma flows away from the chambers to the N and S along the faults, but largely remaining underground. The magma ultimately solidifies to form dykes in the existing strata and is the agent which pushes the plates apart and creates the accretion boundary.

Io's volcanoes The year 1979 was marked by the astonishing success of the missions of the 2 Voyager spacecraft to the Jovian system. Voyager 1 took a fast trajectory to Jupiter and arrived in March; Voyager 2 was in fact launched first and took a longer route, arriving in July. It is destined to fly on to Uranus and possibly to Neptune. In addition to details of the planet itself, both spacecraft were able to send back to Earth details of data on 5 of the 13 or 14 moons of Jupiter. One of these was the third largest, Io (diameter 3640km—about the same size as Earth's moon), which was revealed as being the most volcanically active body in the solar system. Voyager 1 detected at least 8 active volcanoes, one of which was found to have ceased its activity when observed by Voyager 2. The atmosphere of the moon is apparently largely composed of sulphur dioxide, and sulphur and oxygen in ionized forms—a very inhospitable place. The surface of the satellite is coloured red and orange, and this is suggested as being due to the various different forms of sulphur or sulphur dioxide frost. In addition to the active volcanoes, the surface is also covered with very large volcanic calderas, 10 to 100 times larger than those on Earth. The interior activity of the moon is thought to be caused by 'tidal heating' as Io is tugged one way by the great mass of Jupiter and by Ganymede and Europa, the next 2 moons, in the other. However, apart from the volcanic 'hotspots', the moon's surface is apparently cold, −140°C.

Plate tectonics and New Zealand The islands of New Zealand lie close to the boundary between the Pacific and Indian plates—the N Island and the northerly part of S Island on the latter, the remainder of S Island on the former. This boundary, which is moving at some 30–50mm/annum, passes to the N close to the Kermadec Trench and to the S continues towards Macquarie Island. In the N the Pacific plate is moving W underneath the N Island of

New Zealand, in Fiordland (S Island) the reverse happens, a small section of the Indian plate is plunging to the E. Where the boundary crosses S Island the plates are both continental and so unsinkable; they are therefore compressing and sliding past each other forming the S Alps and the Alpine Fault. (This last is clearly visible on satellite pictures.) A total uplift of 20km has taken place in the Alpine region.

Since earthquakes take place where plates plunge, New Zealand is markedly subjected to them; one of the worst was at Wellington in 1855. There are also many signs of volcanic activity, eg Tarawera 1886. Three of the major cities—Auckland, Christchurch and Dunedin—are on or adjacent to volcanoes. The most recent activity has taken place in the line of volcanoes which runs from Ruapehu to the N coast of N Island (White Island). The biggest event in the last 10,000 years was the Taupo ash eruption of AD 130, which covered 18,000km^2 to a depth of 30cm.

'To New Zealand plate tectonics represents more than an elegant geometric exercise, played out in academic and conference circles. It creates the very environment in which the people live.' The underground heating is used for power generation, industrial processing and heating. Fertile forests grow on soils of volcanic origin. Huge faults determine the landscape; the best known is the W flank of Wellington harbour. The lakes of the Alps provide copious hydro-electric power.

Ice-core records from the Peruvian Andes During the last few years ice-cores extending to bed-rock have been obtained from the Greenland and Antarctic Ice-caps and from glaciers in high latitudes. Isotope and particle studies have enabled temperature variations in the 2 ice-caps to be compared on a time scale of millenia. Until recently there was no comparable work being done in the tropics, a gap which is now being filled by a project on the Quelccaya Ice-cap in the Peruvian Andes. This covers 55km^2 and has a summit elevation of 5650m. It was preferred therefore to the N Wall Firn of Mount Jaya, Indonesia and Stanley Plateau on the Ruwenzori, both of which are at lower elevation and have relatively higher air temperatures. Extensive studies have been initiated on the Peruvian site by Ohio State University Institute of Polar Studies and the Instituto de Geologia y Mineria of Peru, and properties of a short core correlated with climatic changes over the last decade. An ice-core down to bed-rock, scheduled to be taken in the near future, will enable comparative studies to be extended back to AD 1500.

Earth sensing from orbit The number of satellites and the complexity of their associated equipment are increasing rapidly, enabling all manner of earth studies to be carried out from space. They contribute to our knowledge of global weather, severe storms, temperature, humidity, wind strength and so on almost indefinitely.

The various Nimbus flights have carried out a wide variety of measurement experiments covering the whole range of earth and air sciences. An example of the information which is being acquired is given by observations of the Antarctic by the Advanced Vidicon Camera. Mount Siple, over 3000m and an important navigation aid, was moved 2°W (222km) of its previous chart position based on Nimbus data. Corrections were made also to the outline of the coast.

The surface of Venus The Earth's multitude of orbiting satellites can as indicated provide many types of information about our planet's surface; the Pioneer spacecraft went into orbit around Venus in early December 1978, and has sent back data derived from radar observations of the planet's surface. So far, the discoveries can be fairly described as spectacular; a Venusian mountain higher than Everest, a high plateau larger than Tibet, 2 huge volcanic peaks and a form of atmospheric circulation quite different from others known in the Solar System involving winds of 640km/hr. The plateau's dimensions are 3200km by 1600km and it is at a level 5km higher than the land to the S of it. On the E edge lies a peak that appears to rise 12,000m above the equivalent Venusian sea-level on the waterless surface. It seems that the plateau and its associated mountain ranges are the result of conventional tectonic activity rather than vulcanism. However, 2 other groups of peaks on other parts of the planet's surface are apparently volcanic in origin and very big, the largest rising to a height of 6000m.

UNESCO in Austria A UNESCO project has been promoted to save the Austrian Alpine village of Obergurgl from the physical and economic pressures of tourism. This falls under

their Man and the Biosphere Programme (MAB) in Section No 6 dealing with 'The Impact of Human Activities on Mountain and Tundra Ecosystems'.

The first tourists came to Obergurgl a century ago, but for much of this time they have made but little impact. The age of mass tourism which began after the Second World War has been described as 'second only to an atomic holocaust in its power of destruction'. 'The population', writes the *New Scientist*, 'now numbers 300, but the 12 farmers, 135 cows, 150 sheep and 15 horses are vastly outnumbered by the 40,000 tourists who come each year and are accommodated in a total of 2500 beds provided by 70 hotels, pensions and inns'. These hotels were built on former grazing land, so that the village is now completely dependent on tourism and agriculture has become unimportant.Winter use (ski-ing) is 3 to 4 times higher than summer use, so that local people rely on winter money to see them through the year. In the summer 40% of visitors hiked in high Alpine areas, 10% went mountaineering, 35% used easier paths at lower altitudes, while 10% stayed with their cars. They come mostly from the UK and West Germany.

Extensive studies of the area are being made in many scientific disciplines; in fact this is the most advanced of any such UNESCO project. The results are likely to have important application in mountain areas, not only in the Alps but all over the world.

Alpine Club Notes

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General Meetings of the Alpine Club 1979

16 January	Peru 1977: Richard Toon
13 February	Jannu 1978: Rab Carrington
13 March	The Snow Mountains of New Guinea: Peter Boardman
24 April	The South-West Buttress of Changabang: John Porter
15 May	The Mountain Scene—watercolours by British Artists: Peter Bicknell
25 September	Kangchenjunga 1979: Joe Tasker
23 October	Exploration of the Darwin Range, Tierra del Fuego 1979: John Earle
20 November	New Peaks in Afghanistan—Exploration and first ascents in the Qalat Valley in 1977: Richard Eastwood
10 December	Annual General Meeting followed by the President's Valedictory Address
11 December	Annual Dinner

Other Events in 1979

A joint meeting with the Royal Geographical Society was held at the RGS on Monday 26 March. Peter Habeler gave a lecture entitled 'Everest Without Oxygen'.

The Alpine Club, Alpine Ski Club, Eagle Ski Club and the Ski Club of Great Britain jointly organized a Symposium on Avalanches which was held on Saturday 10 November. A day meeting was held at Middlesex Hospital followed by a buffet supper at the Alpine Club.