A hundred years ago

Mirage on Snowdon

On Monday, July 12, I, with a party, ascended Snowdon. The atmosphere was clear until we had reached within half a mile of the summit, when a light cloud rising stealthily from amongst the southern peaks enveloped it. Drifting towards us, when very near, the cloud dropped over the eastern shoulder of the mountain just where it dips towards Capel Curig. As we stood watching, great was our surprise and delight as we beheld painted upon it, not the *arc-en-ciel* with which we are familiar, but a complete and brilliant prismatic circle, apparently about thirty feet in diameter, in the very centre of which we ourselves were depicted, the image being somewhat enlarged but clearly defined; as we arranged the party in groups, or bowed to each other, every form and movement was faithfully reproduced in the picture. It was now about 8 o'clock, with the sun nearly in a line with us. Our guide, who had made some hundreds of ascents, had never witnessed such a sight before.

H. J. Wetenhall

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tektites being produced by fusion between volcanic emanations and country rocks. A simpler theory postulates that tektites are shed melts derived from ablating meteorites. But tektites are acidic and all known meteorites are basic.

Lunar theories propose that the tektites are ejected from the Moon in a molten form during the formation of craters by meteorite impact and during periods of lunar volcanic activity. The composition of tektites is hard to account for as most of the material brought back from the Moon has been basaltic rather than acidic. The fact that there are only four age groups of tektites, although the hundreds of thousands of lunar craters were created at many different times, counts against the impact ejecta theory. Also impact craters mainly eject matter at low angles.

Lunar volcanic ejecta as a source of tektites is strongly advocated in the recent paper of Cameron and Lowrey in *The Moon* (**12**, 331; 1975). Reliance on a volcanic ejection process can explain the rarity of tektite falls on Earth and their composition. The velocity of escape they need to leave the Moon requires the volcanism to be of the explosive type which terrestrially is usually associated with acidic suites. (Acidic lavas, which have very high viscosities of 10^{12}–10^{13} poise, can sustain very high pressures before disruption. This leads to massive rock and lava ejection, as with Krakatoa which ejected 18 km^3.) As the youngest tektite is only 0.6 Myr old, lunar volcanic activity must have been very recent—and the authors tie this in with observations of lunar transient phenomena—mild degassing observed from time to time around certain craters. The lack of H_2O in lunar samples is also echoed in tektites.

Tektites ejected vertically from the Moon at a speed of 3 km s^{-1} will only reach the Earth if they start from a small area on the eastern hemisphere within 6° of the lunar equator. The orbits are hyperbolic with respect to the Earth–Moon system so if the tektite misses the Earth on the first pass it goes into a heliocentric orbit. In searching for the exact point of origin Cameron and Lowrey regard 'lunar transient phenomena' sites within the specified boundaries as prime suspects, provided, however, that other evidence of volcanic activity can be found in their vicinity. The sites are all ray craters—Censorinus, Taruntius, Messier and Messier A (the old Pickering) and it is postulated that the rays are whitened exposed rocks which have had their dust covering blown off by gases emanating from the craters. Censorinus AB has a central mound with a funnel-shaped crater similar to those of terrestrial diatremes, fumaroles and explosion pits, all manifestations of volcanism. The hummocky bands in Messier, some of which have summit craters, are also pointers towards volcanism. Steep sloped ridges inside Taruntius indicate that volcanism could have post-dated the impact explosion.

The source of tektites must lie deep within the Moon because tektites differentiated in the last 10^9 years when the Moon's heat was confined to very deep regions. Cameron and Lowrey postulate that diatremes coming from these depths discharged their ejecta vertically; and that craters such as Messier were formed by impact and then suffered volcanism because the craters were formed on mare surfaces, the scenes of original volcanic flows.

So old lunar volcanoes, the present day sites of transient lunar phenomena, provided they are in the right area of the Moon, can eject tektites which will hit the Earth. But why have these only erupted in the last 34 Myr? Why are the tektites so tightly bunched in space that they only produce small strew fields on Earth? How does such pure differentiated material get produced on the Moon? Where are all the tektites that missed the Earth the first time, only to fall to Earth an indeterminate time later? Many questions remain unanswered; these enigmatic tektites have been bothering scientists since the eighteenth century and I am sure will continue to do so long into the future.

Far infrared astronomy

from M. Rowan-Robinson

The first international conference devoted exclusively to far infrared astronomy was held at Cumberland Lodge, Windsor Great Park on July 9–11. It was organised by Queen Mary College, London, and sponsored by the Royal Astronomical Society.

The far infrared is usually taken to mean the wavelength range 30 μm to 1 mm which, being almost inaccessible from the ground, is observed from aeroplanes, balloon platforms or (for the future) satellites. One of the most interesting discussions was of the relative merits of NASA's proposed Large Space Telescope (LST), a satellite-borne 60-cm telescope which will operate in the optical and ultraviolet as well as the infrared (plans were reported at the meeting by D. E. Kleinmann of Harvard), and balloon-borne telescopes working at an altitude above 30 km. One advantage of balloon-borne systems is that they are already in action. The University College, London group reported the latest results of their broad-band (40–300 μm) survey of the galactic plane and maps of some individual sources, while G. G. Fazio of Harvard described 70 μm studies of several galactic HII regions and some external galaxies. K. Shivandan of Naval Research Laboratories, Washington, described multicolour photometry of the Orion nebula, and several groups described interferometer systems to be flown on aircraft or balloons giving detailed spectra of strong sources in the far infrared.

Another area of outstanding interest was the microwave background, with reports of Queen Mary College's balloon-borne interferometric observations in the range 0.7–2 mm and of Leeds's forthcoming experiment. Although the Berkeley group, who have recently successfully repeated the experiment, were not represented, much of the discussion centred on the conflicting atmospheric measurements and interpretation of the Queen Mary College and Berkeley groups. The issue remained unresolved, partly due to ignorance about the amount of ozone at altitudes above 30 km, and it is to be hoped that the Leeds experiment this summer will help resolve the issue. However both groups agree on the major issue, that the cosmic background spectrum turns over shortwards