

## NEWS AND VIEWS

## Anatomy of Lunar Magic

AS far as petrologists were concerned, the National Aeronautics and Space Administration programme for the investigation of lunar rocks could hardly have been better timed. In the early 1960s petrologists had acquired a new tool, the electron microprobe, comparable in importance to the hammer and the polarizing microscope. By July 1969, when the Apollo 11 mission returned, most of the teething troubles of the new instruments had been overcome; the precious nature of the lunar samples, the fine size of the grains, extreme textural disequilibrium and the need to obtain results quickly all combined to demonstrate the power of this analytical method. Within a few months of the samples being collected, the essential features of the crystallization path of lunar basalts had been established: early growth of magnesium-rich olivine and pyroxenes, oxide phases and calcic plagioclase results in extreme iron enrichment of the remaining liquid which precipitates small quantities of a sulphide liquid and a siliceous, potassium-rich liquid.

In the immiscible "granitic" liquid are concentrated potassium, rubidium, thorium and uranium, the long-lived isotopes of which are a vital aid in understanding the chronology and heat budget of the Moon. Also concentrated in this liquid are a group of trace elements, including barium, yttrium, rare earths, zirconium, hafnium, phosphorus and niobium, about which are centred many of the geochemical arguments concerning the differences between terrestrial and lunar rocks. Humorists at the California Institute of Technology have coined the names KREEP and Magic Component for material rich in these trace elements. Clearly, a knowledge of the petrology of the "potassic granite" material is of importance in understanding how it is produced and where it is likely to be found on the Moon elsewhere than in the basalts.

Here again, the electron microprobe is proving its great value; on page 215 of this issue of *Nature* Professor G. M. Brown's lunar team at the University of Durham report the discovery of two new zirconium-rich phases and review the mineralogy of Zr-Ti-Fe oxides found in the lunar granitic material. The most abundant zirconium-rich phase in the lunar basalts is the recently discovered mineral tranquillityite (type locality: the Sea of Tranquillity) which contains about 15 per cent  $\text{SiO}_2$  in addition to large amounts of  $\text{FeO}$ ,  $\text{TiO}_2$  and  $\text{ZrO}_2$  and lesser amounts of  $\text{Y}_2\text{O}_3$  and rare earth elements. Before the discovery of tranquillityite, the potassium-rich mineral whitlockite was the only identified carrier of rare earth elements in more than trace amounts; enrichment of rare earths in another group of lunar minerals, with a potentially different stability range, increases the possibilities for using this group of elements in interpreting the Moon's petrogenesis.

Peckett *et al.*'s new phases "X" and the aptly called yttrium-rich phase "Y" are essentially silica free, as are other Fe-Ti-Zr oxides reported by other investigators. The

appearance of zirconian  $\text{SiO}_2$ -free minerals in the granitic fraction is rather strange, for terrestrial granitic rocks invariably contain zirconium as the silicate  $\text{ZrSiO}_4$ , and baddeleyite,  $\text{ZrO}_2$ , and the compound oxide zirkelite are restricted to rocks in which silica activity is very low indeed. These last rocks lie at the end of an evolutionary process in which sodium is often enriched in the residual liquids making them strongly alkalic. The puzzling paucity of sodium in lunar rocks tends to obscure the fact that their geochemistry otherwise shares more aspects with terrestrial alkalic than tholeiitic rocks; it is possible that the sodium deficiency of the lunar surface rocks can be attributed to a loss of vapour at the time of eruption.

As Peckett *et al.* stress, the petrogenetic value of their work will only be realized by experiments of the stability relations of the newly identified minerals; certainly the analytical work has posed the problems and suggests a chemical system suitable for their investigation.—From a Correspondent.

## Infrared Spectra and DNA

COMPARED with the wide application of optical spectroscopic techniques (ultraviolet, optical rotatory dispersion and circular dichroism), infrared spectroscopy has been little used in physical biochemistry, probably because in the early days of the technique the acquisition of infrared spectra was considerably more difficult than for the visible and ultraviolet region of the spectrum. Furthermore, it is difficult to work with dilute aqueous solutions because of the absorption of the solvent. Nevertheless, unlike the optical region, the infrared spectrum contains many absorption bands and in theory the technique is capable of giving detailed information.

With improvements in reliability and reproducibility of infrared spectrometers which allow the accurate monitoring of changes in spectra, there has recently been an increase in the application of the technique to molecular biophysics. This aspect was demonstrated several years ago by H. Todd Miles and his colleagues (for example, S. C. Howard *et al.*, *J. Mol. Biol.*, **16**, 415; 1966), who monitored the changes in intensities of infrared bands characteristic of different helical conformations of synthetic polyribonucleotides with themselves and with purine nucleosides and nucleotides. A recent prominent defector from the short wavelength region of the spectrum is J. Brahms, who is well known for his contributions to circular dichroism studies of oligonucleotides, polynucleotides and nucleic acids. Brahms and his colleague Pilet have used polarized infrared spectroscopy to follow the B→A transition in sodium salts of DNA (*Nature New Biology*, **236**, 99; 1972).

Polarized infrared spectroscopy is a powerful technique for obtaining information on the conformation of poly-