In the case of hot spots which coincide with craters it is very unlikely that the spots can be attributed to local heat sources since these craters have been shown to be cooler than the surroundings during the lunar day[4]. The case of the crater Tycho is particularly interesting since radar reflexion results[5] give strong back reflexion (indicating a rough *or* a more dense surface) while the infra-red eclipse measurements show this crater to be a very intense hot-spot. More generally, the spots are found to be associated with maria as well as crater centres[1]. The present hypothesis therefore requires that these regions have preferential roughness. Such an explanation is in good agreement with visual results. It is well known that the albedo for crater centres and maria is in general lower than that for lunar highland while rougher surfaces have in general a lower albedo than smooth ones.

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PHYSICS

Lattice Constants of Gallium at 297° K

THE a and b lattice constants of gallium (orthorhombic, D_{2h}^{18}—$Abma$) are almost identical and have often been a source of confusion, as has recently been emphasized by Yaqub and Cochran[1]. Diffractometer data at 4·2° K (ref. 2) (gallium of 99·9999 per cent grade) indicated $a = 4{\cdot}5156$ Å, $b = 4{\cdot}4904$ Å, $c = 7{\cdot}6328$ Å, but at 297° K it appeared that a is smaller than b (in disagreement with Bradley[3]), and therefore that at an intermediate temperature (near 255° K) a should become equal to b.

An experimental investigation of mechanical twinning at different temperatures, involving compressive and tensile stressing, proved that twins could be produced by compression along a and tension along b[4,5], whereas neither tension along a nor compression along b produced twinning, a result interpreted to imply that a is greater than b at 297° K, and bringing the 1961 conclusion into question. Furthermore, it was found that tensile stressing along a at 255° K produced no twins, whereas if $a = b$ at this temperature, twinning would be expected[4] on the basis that the occurrence of twinning is associated with the elastic anisotropy ($S_{22} > S_{11}$).

The 1961 conclusion for 297° K was independently brought into question by Cochran[6], who noted that the expansion coefficients for a and b were in disagreement with Powell's[7] and could be brought into better agreement if the 4·2° K results of 1961 were accepted but if a were assumed to be greater than b at room temperature as well as at 4·2° K.

The 297° K powder diffraction data of 1961 have now been re-computed using new indices for the reflexions, corresponding to $a > b$, bringing the calculated value ($\theta_{304} - \theta_{142}$) much closer to the observed value of this significant angle. The new indexing leads to least squares solutions (either with various extrapolation factors or without corrections) that invariably give better overall agreement between calculated and observed θ values than the 1961 indexing. The Vogel–Kempter and the Nelson–Riley extrapolation functions both yielded the following results:

	a (Å)	b (Å)	c (Å)
Re-computed values	4·5258 ± 0·0007	4·5186 ± 0·0007	7·6570 ± 0·0012
Bradley (ref. 3)	4·5258	4·5198	7·6602

The agreement with Bradley's values (converted by the factor 1·00202) is much improved. The results now do not conflict with the anisotropic expansion coefficients of Powell[7], assuming that the θ-values of 1961 at 4·2° K are correctly indexed, which we have no reason to question. We therefore conclude that the 1961 values at 297° K should be replaced by the foregoing, that the interpolated values of 1961 for 78° K should be discarded, that $a > b$ throughout the temperature range, and that the anisotropic thermal expansion is such that $\Delta b/b > \Delta a/a$.

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GEOPHYSICS

Linear Relationship between Energy and Pressure of Volcanic Explosions

EARLY investigations on the velocity of bombs and the gas pressure of single volcanic explosions by Matuzawa[1-3] led to a means of determining gas pressures which have been generally accepted and used by volcanologists. Matuzawa stated[1] that the initial discharge velocity of volcanic explosions depended primarily on the gas pressure, which could be calculated from the dynamic pressure relationship of Bernouilli's equation:

$$P = \frac{1}{2}\rho v^2$$

where the gas pressure, P, represents the pressure difference between the interior and exterior of the vent, ρ is the density of the mass of fragments plugging the vent, and v is the discharge velocity of volcanic bombs.

Results of investigations by Minakami[4] led to the determination of the amount of kinetic energy necessary to impart the initial velocity to volcanic ejecta (bombs):

$$E = \frac{1}{2}mv^2$$

where E is the kinetic energy, m is the mass of ejecta, and v is the velocity of ejecta at the instant of ejection.

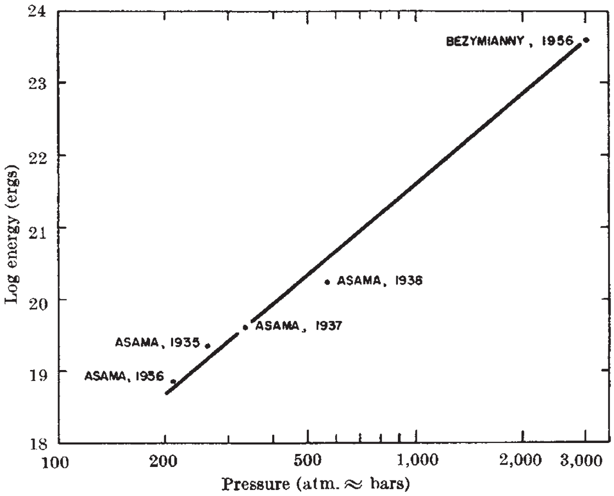

Fig. 1. Relation of the logarithm of kinetic energy of volcanic explosions to the logarithm of the gas pressure at the time of the explosion