Interior

The seismometers installed by the Apollo missions have recorded waves from both moonquakes and from the impact of natural bodies and spent spacecraft stages. More than 3 000 natural moonquakes have been recorded per year. The majority of these occurred at very great depths (about 900 km), with just a few taking place in the topmost crustal layer. There are more moonquakes when the Moon is at perigee, once more suggesting that tidal forces are important. A 206-day period is also detectable and this can be related to orbital perturbations by the Sun.

Table 5·5 **Density of lunar rocks**

		density range (kg per m³)	
crust	highland rocks	2 750–3 000	2 950 mean
	mare basalts	3 300–3 400	
	lower crust	3 000–3 100	
lithosphere, asthenosphere and core (if any)		3 390 (bulk density)	
Moon total		3 340	

The picture of the interior which has been built up from the seismic evidence is shown in Fig. 5·8 and data on the lunar rocks and crust are given in Tables 5·5 and 5·6. In contrast to the Earth, the Moon is rigid down to a depth of about 1 000 km, below which there is a weak, possibly molten, zone. It is difficult to estimate the temperature at the centre, but it is probably in the region of 1 300 K. As the overall density of the Moon is much less than that of the Earth (3 340 kg per m³ against 5 517 kg per m³) it cannot have a very large metallic core of iron and nickel, and the centre is probably composed of a mixture of iron and sulphur, with perhaps a very little nickel. Rock samples indicate that the Moon had a magnetic field a very long time ago, although there is none now, and this could have been produced by such a composition when most of the interior was fluid.

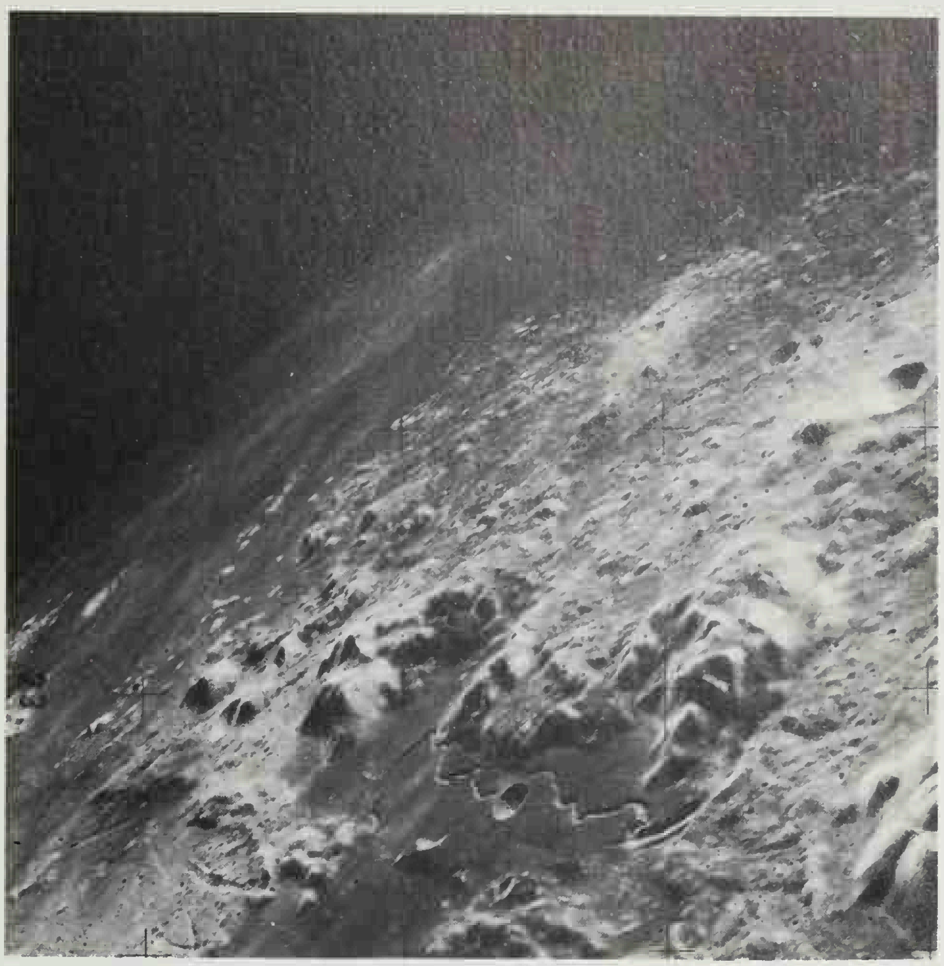
Mascons

Analysis of the motion of spacecraft in orbit around the Moon – largely the Lunar Orbiter series of craft – showed certain positive gravity anomalies in restricted regions. These mass concentrations, or **mascons**, were found to underlie the circular maria in particular. The exact circumstances of their formation are still subject to debate but it would appear that some impact basins became the sites for a concentration of denser material either at the surface or at depth. Normally on a body like the Earth, any concentration of or reduction in the mass of the rocks at any one point is compensated by the rising or sinking of the crust and a displacement of material at great depth. This mechanism, known as **isostasy**, gives rise to an approximate equilibrium everywhere. However, on the Moon, with its thick, rigid crust and lithosphere, this has not occurred in all cases, thus giving rise to the mascons, and the less pronounced negative gravitational anomalies.

Table 5·6 **Structure of lunar crust**

	approximate thickness	
regolith	3–40 m	total crustal thickness 61 km (approx).
mare basalts	<20 km	
brecciated crust	25 km	
lower crust	35 km	

A denser sub-crustal layer may exist between depths of 60–150 km.



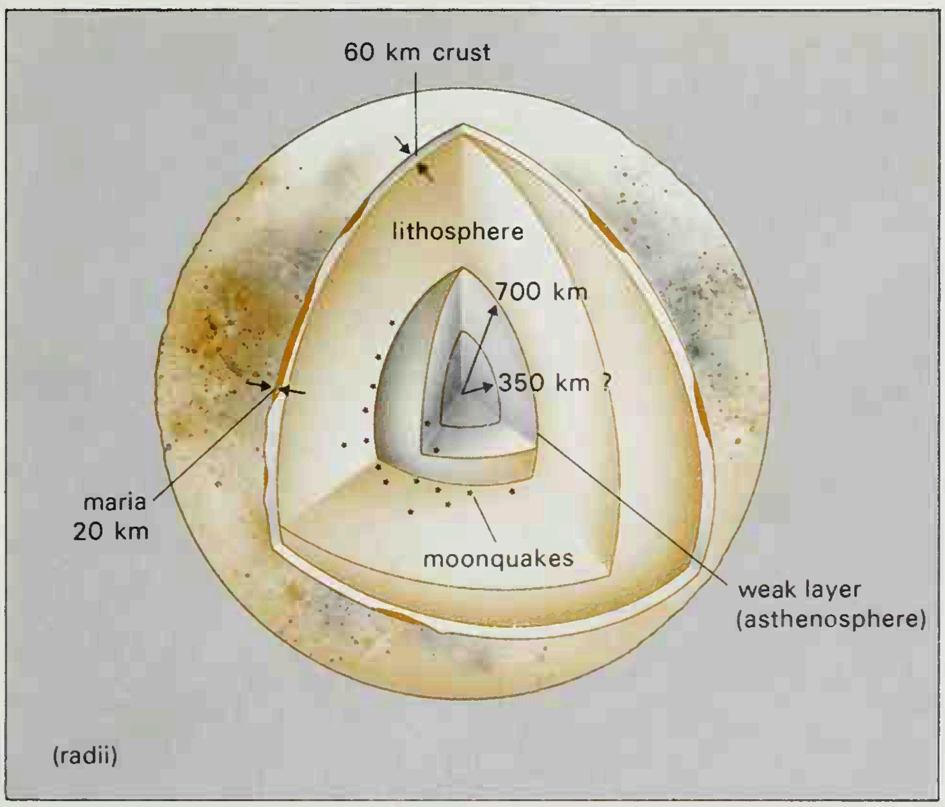


Fig. 5·8 The interior of the Moon, showing the position of the major moonquakes. The thickness and irregularity of the crust are exaggerated, as is the depth of the mare basins. The weak layer may extend to the centre, or there could be a completely solid inner region.