Jupiter, as photographed by the spacecraft Voyager 1 on 1979 January 29, from a distance of 35·6 million kilometres. This composite has been assembled from images obtained through three colour filters. Great detail is shown in the area surrounding the Great Red Spot and in most of the belts and zones, including tiny red spots in the northern hemisphere.

The driving mechanism for this activity is uncertain as the temperature difference between equator and poles due to solar heating is very low (only about 3 K), and in any case little poleward flow occurs, unlike on Venus and the Earth. It is thought that the persistent circulation pattern could well be the result of deep-seated processes occurring at lower layers of the atmosphere or in the planetary interior, and the strong zonal flows are certainly related to the high speed of rotation of the planet. The observed average atmospheric temperature of 125 K is higher than could be produced by solar radiation alone (about 105 K) and has long been known to be due to a flow of heat from Jupiter's interior. The interior heat source contributes about 1·7 times the heating produced by the Sun, and is likely to be mainly due to residual heat from the time of the planet's formation (when the temperature in the deep interior is thought to have been around 50 000 K).

It has now been established that the white zones are, in general, the cold tops of rising air masses, the clouds being formed of ammonia crystals at temperatures of about 141 K. The darker belts are descending currents with a higher temperature – reaching as much as 149 K. However, there are significant exceptions to the dependence of colour upon height, the Great Red Spot being the obvious example as this feature is both high and cold. The Great Red Spot has much in common with the more numerous white ovals and they can all be likened to the persistent high-pressure areas which occur on Earth. The exceptionally long lifetime of the Jovian features (the Great