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The Face of the Earth and those of her sisters: why are they so different?

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The terrestrial planets, Mercury (uncompressed density: 5.3 g/cm3) Venus (4.4), the earth (4.4), and Mars 3.8) and the Moon, the rocky satellite of the earth (3.3), have formed some 4500 to 4600 million years ago through gravitational accretion about individual centres of attraction around the Sun. Yet all five have very different "faces" to use Eduard Suess' happy expression (adopted by Alfred Wegener for the Moon also). The earth looks blue when viewed from space because of Rayleigh scattering in its atmosphere. Venus looks yellowish due to its clouds of sulfuric acid and Mars is buff because of its dusty atmosphere. The earth's hypsometric curve is double-peaked; Mars' approaches the earth's. The others have single-peaked curves. Mercury and the Moon are very similar-looking, but this is deceptive: we now recognise that Mercury has extensive thrust faulting resulting from planetary contraction; the Moon probably has contractional structures, but on an incomparably smaller scale. Venus has an active interior albeit incapable of dividing its surface into horizontally-moving plates. Mars has a less active interior, but it seems nevertheless active with volcanism as recently as 2 Ma ago. Venus and Mars have plume-dominated tectonics. The earth gets its heat out by plate tectonics (but also by plumes) creating its most distinctive facial features: the orogenic belts and the oceans. The differences among the sisters seem to be due to distance from the sun, accretion history and final size. So far, the most thrilling results concerning their geology have been gained as soon as we obtained the capability of looking at their faces and knock on their rocks.