Komatiites are ultra-hot ultramafic lavas, largely restricted to the Archaean. They represent an extreme endmember of terrestrial magmatism and challenge our understanding of how mantle melting operates and how magmas traverse the crust and erupt at the surface. Their emblematic spinifex textures result from growth of olivine or pyroxene crystals during moderately rapid cooling in the thermal gradient in the upper parts of komatiite lava flows. Despite evidence for moderate water contents in some komatiites, the vast majority require an unusually hot mantle source. The three main types of komatiite - Al-depleted, Al-undepleted and Al-enriched - formed in different ways. High MgO contents, high degrees of partial melting, and evidence of residual garnet in Al-depleted komatiites indicate that melting began at considerable depth in the upper mantle, if not within the lower mantle. Phase changes at the top of the transition zone caused the accumulation of melt in a hot rising plume. Al-undepleted komatiites result from fractional melting of an originally hydrous source. Ti-enriched komatiites and post-Archaean komatiites were produced by smaller degrees of melting of variably enriched or depleted sources, with melting conditions comparable to those of modern picrites.