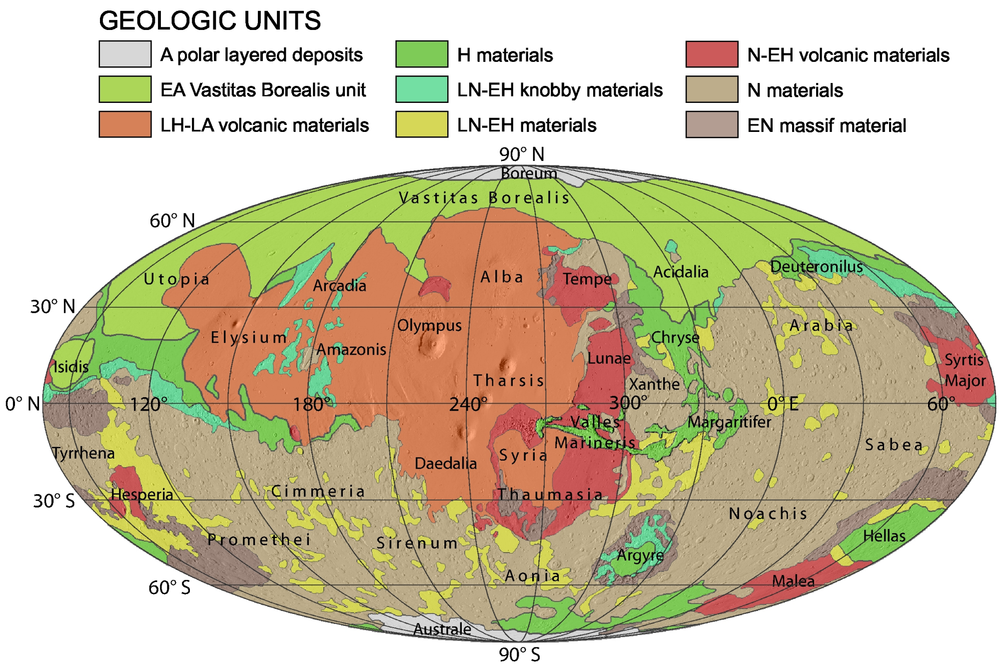

Figure 1: Generalized geologic map of Mars showing distribution of major material types as described in text. Unit age abbreviations: N, Noachian; H, Hesperian; A, Amazonian; E, Early; L, Late. Largely adapted from Scott et al. (1986-87) and Tanaka et al. (2003). Mollweide projection, using east longitudes, centred on 260°E, Mars Orbiter Laser Altimeter (MOLA) shaded-relief base illuminated from the East. On Mars, 1° latitude = 59 km.

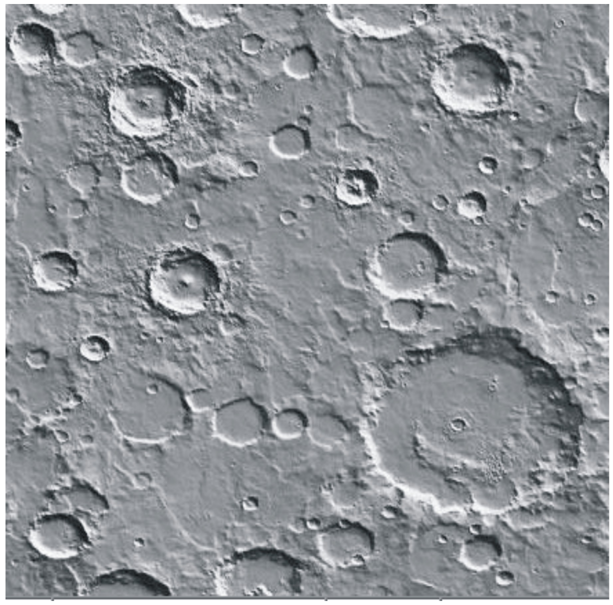

Figure 2: Part of Noachis Terra, Mars, the type area for material of the Noachian Period (Scott and Carr 1978). Shaded relief view from MOLA topography, illuminated from upper right; centred at 44°S, 16°E; image width 600km.

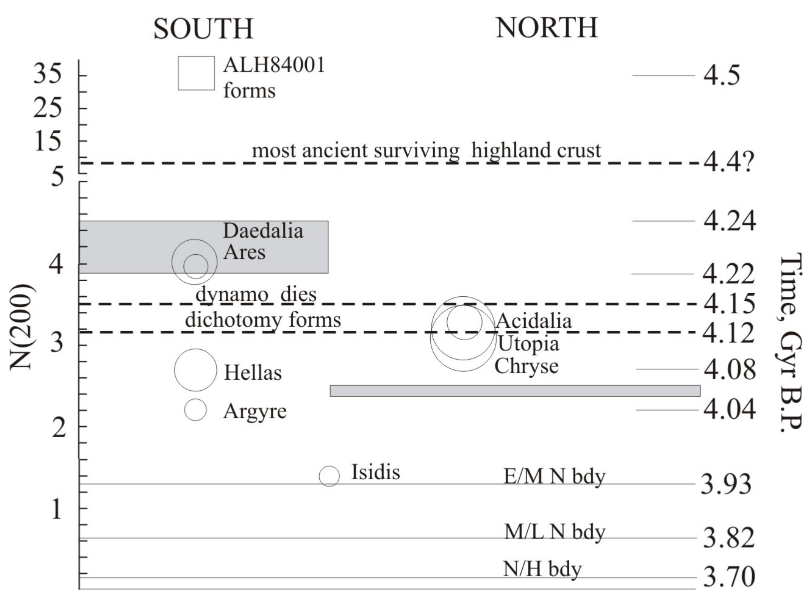

Figure 3: Timeline of events in early Martian history. Left-hand scale is number of craters exceeding 200km in diameter per million square km, from Frey (2004). Note change in interval at N(200)=5. Right-hand scale is time from Hartmann and Neukum (2001, Figure 14), assuming a -2 power law crater size distribution. The formation of the dichotomy and the death of the dynamo probably overlapped in time. Circles are impact basins, scaled to basin size; shaded areas denote crater density

range for buried and total crust (Frey 2004), and place lower bound on basement age. Solid lines depict stratigraphic boundaries, dashed lines major events. See text for a discussion of this timescale.

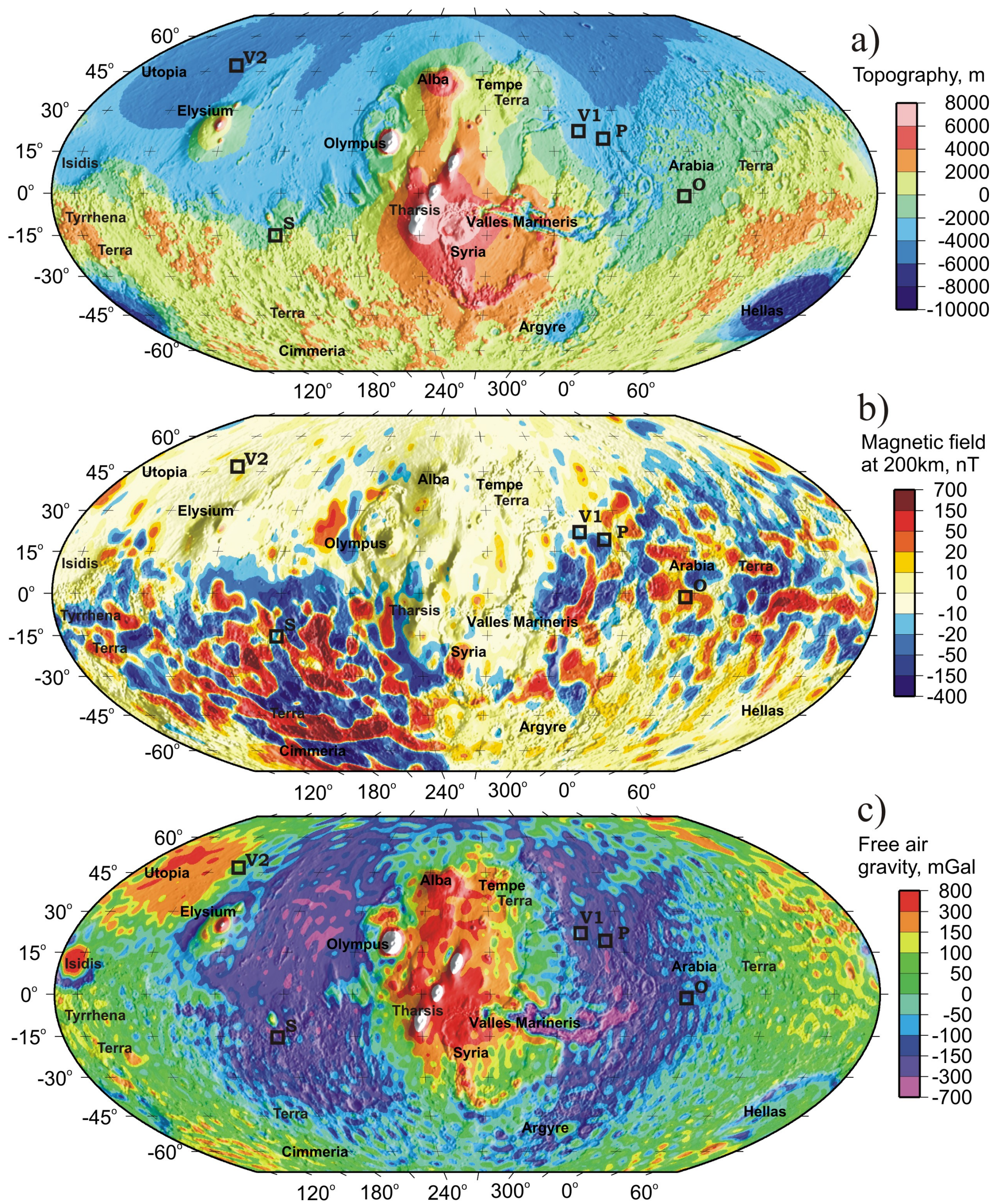

Figure 4: a) MOLA topography, gridded at 0.25° intervals. Squares denote Martian landers as follows: V-Vikings, P-Pathfinder, S-Spirit, O-Opportunity. b) Radial magnetic field at 200km, from Purucker et al. (2000), superimposed on shaded relief topography. Note that colour scale is strongly non-linear. Model uses 11550 equally-spaced dipoles to represent field. c) Free air gravity from model

MGS75D (Yuan et al. 2001), evaluated to degree and order 75.

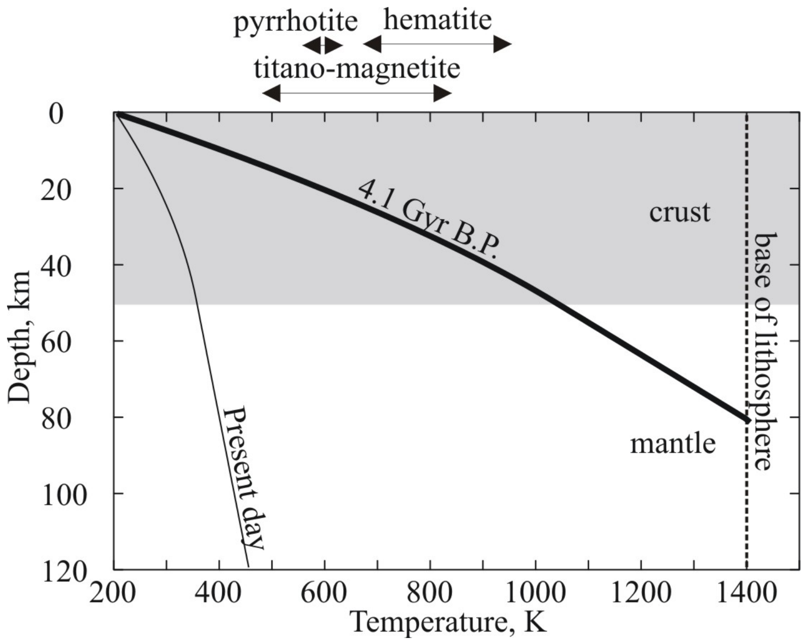

Figure 5: Theoretical temperature profile in Martian crust at 4.1 Gyr B.P. Crustal thickness 50 km, radiogenic element concentrations given in Table 2. These elements were extracted from a mantle with initial concentrations given by Wanke and Dreibus (1994). Depleted mantle heat flux is 33.5mW m^{-2}, surface heat flux 63.4 mW m^{-2}. Thin line gives present day temperature profile (mantle and surface heat fluxes 4.3 and 14.3mW m^{-2}, respectively). Thermal conductivity 3W m^{-1}K^{-1}; arrows denote Curie temperatures of likely magnetic minerals. Using the method and parameters of Nimmo and Watters (2004), a strain rate of 10^{-17} s^{-1} and a curvature of 5×10^{-7} m^{-1}, the elastic thickness T_e at 4.1 Gyr B.P. is 25 km.