January 27, 2003
ES 10 Lecture: James Bartolome
Topic: Cosmology and Early Earth History

1. Hierarchy theory and models
2. Origins of the universe, the big bang
3. Origins of the chemical elements
4. Origin of the solar system and its planets
5. Introduction to comparative planetary science

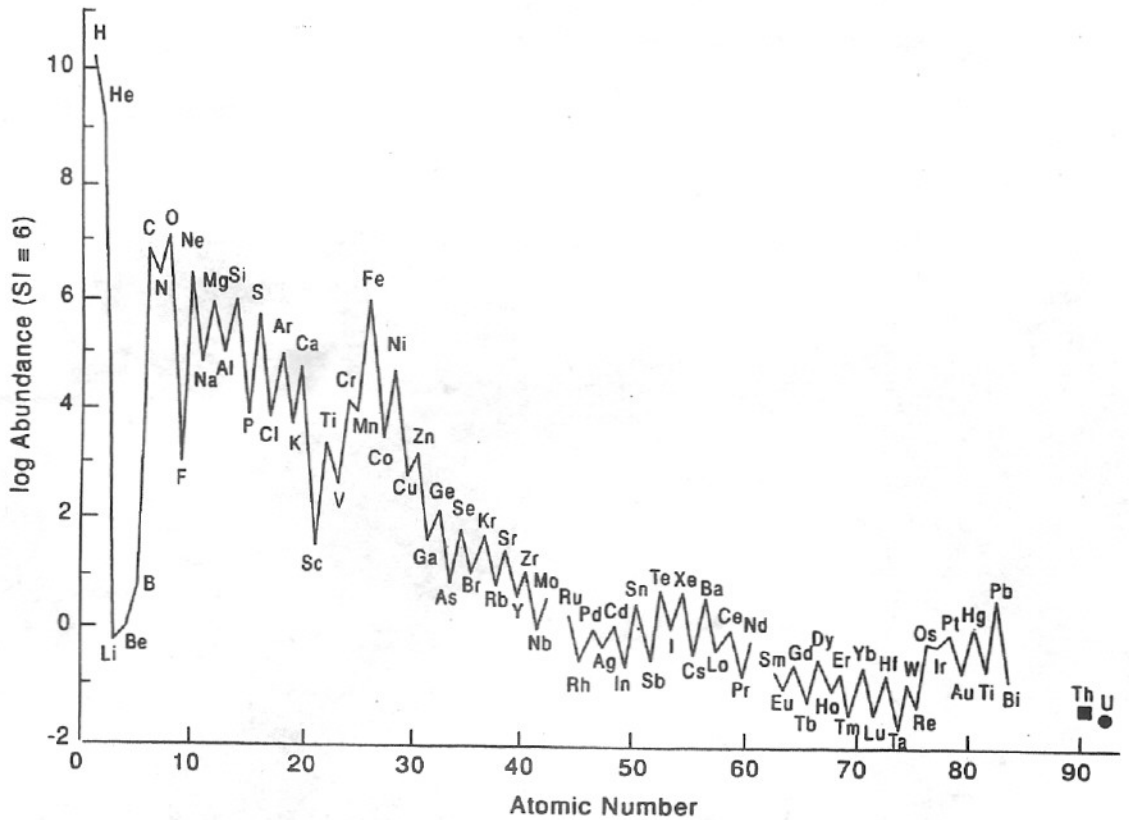

Figure 2.1 The relative abundance of elements in the solar system as a function of atomic number. Abundances are plotted logarithmically and scaled so that silicon (Si) = 1,000,000. From a drawing by Brownlee (1992) based on the data of Anders and Grevesse (1989).

Table 2.3 Some Characteristics of the Inner Planets

	Mars[a]	Earth	Venus[b]
Distance to the sun (10^6 km)	228	150	108
Surface temperature (°C)	−53	16	474
Radius (km)	3390	6371	6049
Atmospheric pressure (bars)	0.007	1	92
Atmospheric mass (g)	2.4×10^{19}	5.1×10^{21}	5.3×10^{23}
Atmospheric composition (% wt.)			
CO_2	95	0.036	98
N_2	2.5	78	2
O_2	0.25	21	0
H_2O	0.10	<1	0.05

[a] From Owen and Biemann (1976).
[b] From Nozette and Lewis (1982).

thick beneath the oceans and 35 km thick (but less dense) beneath the continents.

Miners observed long ago that the deeper their galleries the warmer they found it to work in them. Surface rocks are cool, but below the surface the temperature increases with depth. This is called the 'geothermal gradient'. A little of the Earth's internal heat remains from the time of the planet's formation, but almost all of it is due to the decay of the radioactive elements that are

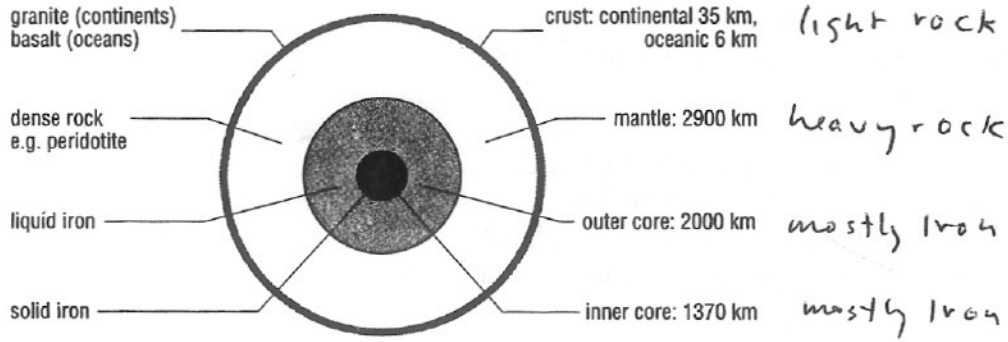

Figure 2.1 ***Structure of the Earth (not to scale)***

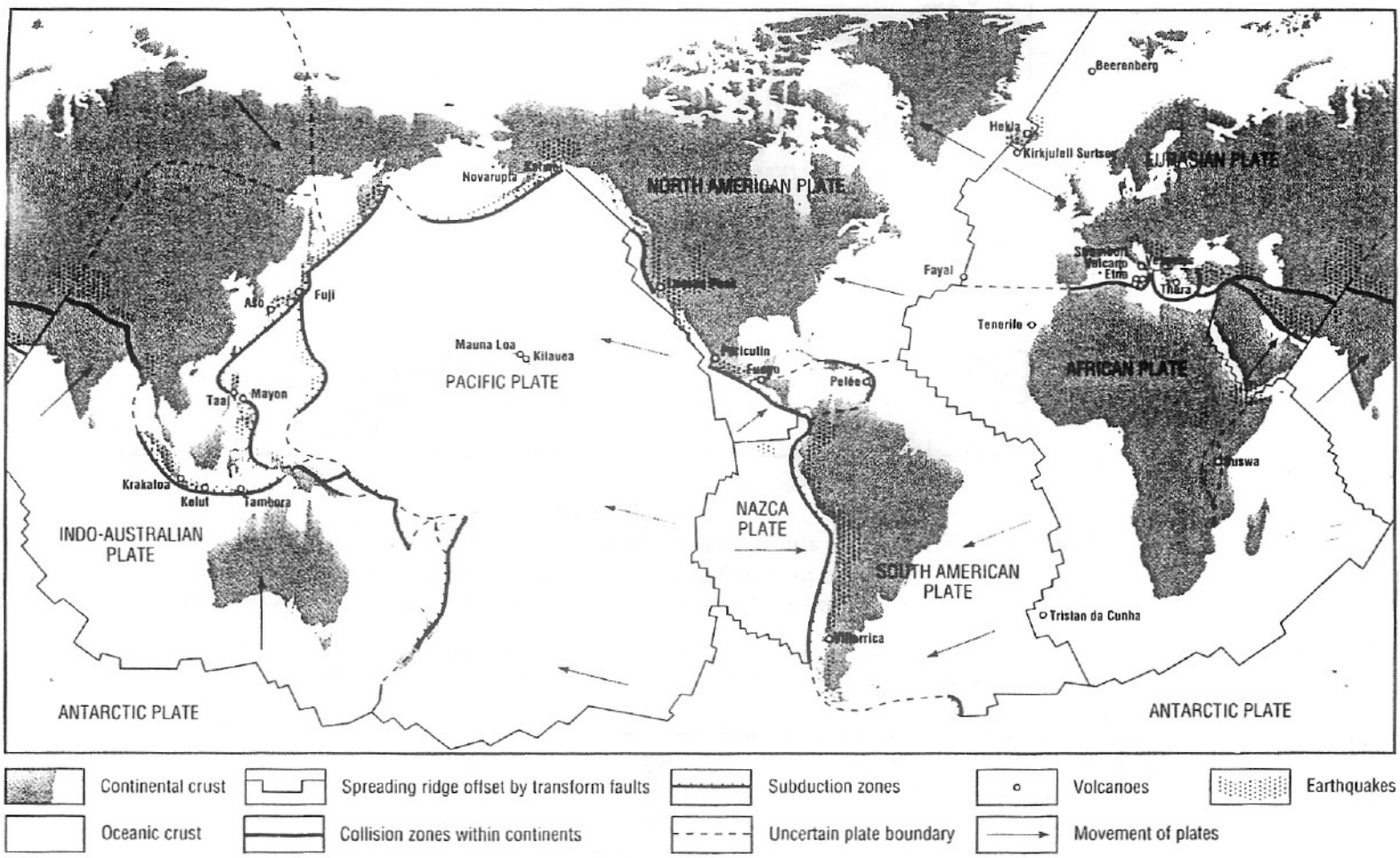

Figure 2.2 ***Plate structure of the Earth and seismically active zones***