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

<table>
<thead>
<tr>
<th></th>
<th>Mars</th>
<th>Earth</th>
<th>Venus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance to sun (10^8 km)</td>
<td>228</td>
<td>150</td>
<td>108</td>
</tr>
<tr>
<td>Surface temperature (°C)</td>
<td>-53</td>
<td>16</td>
<td>474</td>
</tr>
<tr>
<td>Radius (km)</td>
<td>3390</td>
<td>6371</td>
<td>6049</td>
</tr>
<tr>
<td>Atmospheric pressure (bars)</td>
<td>0.007</td>
<td>1</td>
<td>92</td>
</tr>
<tr>
<td>Atmospheric mass (g)</td>
<td>2.4 x 10^19</td>
<td>5.1 x 10^21</td>
<td>5.3 x 10^23</td>
</tr>
<tr>
<td>Atmospheric composition (% wt.)</td>
<td>CO2 95</td>
<td>0.036</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>N2 2.5</td>
<td>78</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>O2 0.25</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>H2O 0.10</td>
<td>&lt;1</td>
<td>0.05</td>
</tr>
</tbody>
</table>

*From Owen and Biemann (1976).

*From Nozette and Lewis (1982).
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 numerous.

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

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