Abundance of the Elements

The diagram below shows the relative abundance of the elements in the cosmos and in Earth's crust. Note that the diagram has a logarithmic vertical scale, and in fact it has two vertical scales offset to separate the cosmic and crustal data.

Things to note:

1. H is by far the most abundant element of the cosmos, and next is He. To astronomers, that's essentially the composition of the universe, and they lump together all the heavier elements as "metals", in a usage very different from that of chemists.

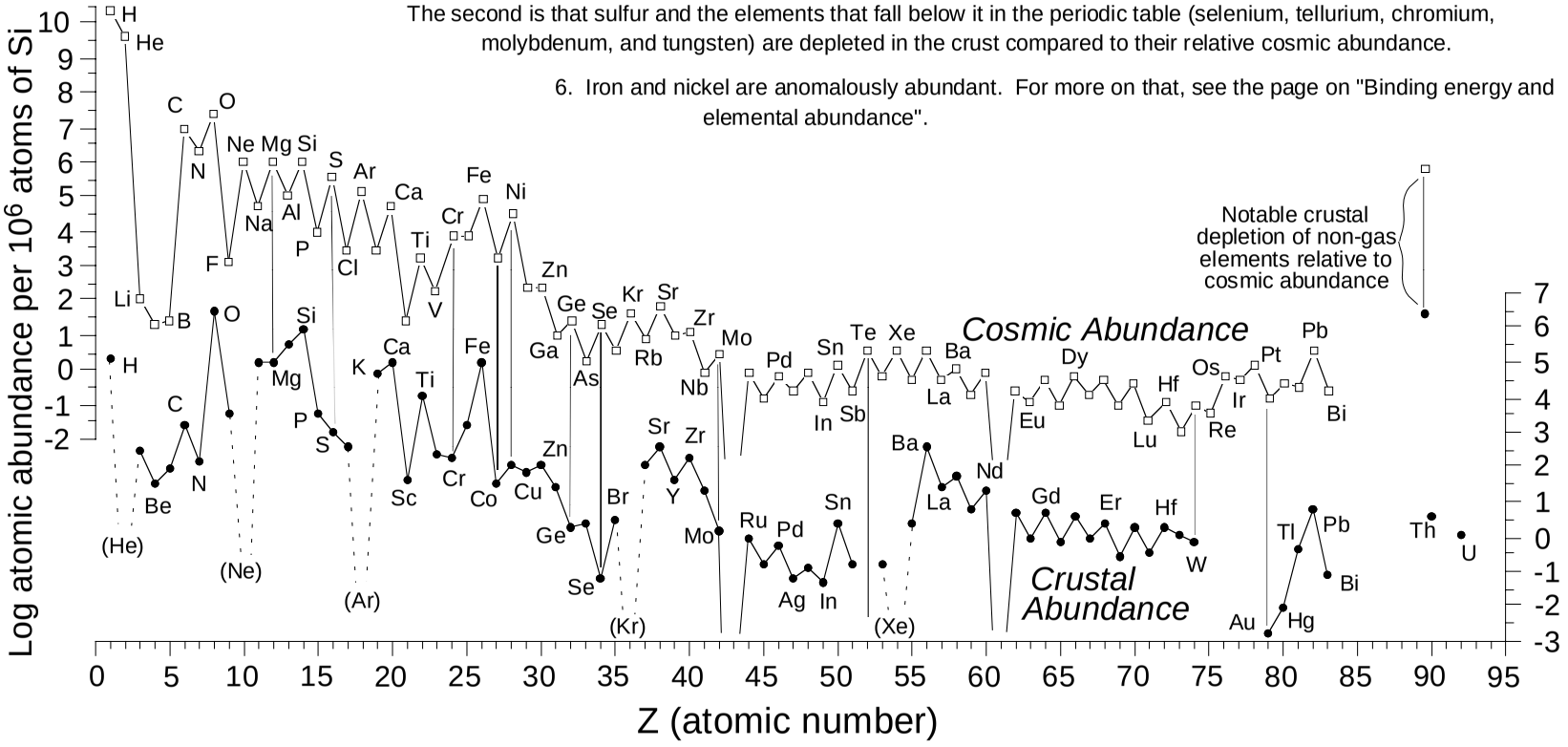
2. In the crust, the noble gases are present in far lower abundance than the other elements, presumably because they have been so prone to escape to (and through) the atmosphere.

3. In the crust, if we except the noble gases, we find that elements of lower atomic number are generally more abundant than those of greater atomic number. For example, all of the elements lighter than copper (No. 29) are more abundant than all of the elements heavier than Samarium (No. 62).

4. The even-numbered elements are generally more abundant than their odd-numbered neighbors. Thus oxygen (No. 8) is more abundant than nitrogen and fluorine (Nos. 7 and 9), and barium (no. 56) is more abundant than cesium and lanthanum (Nos. 55 and 57). This leads to the zig-zag pattern in the diagram.

5. The pattern of elemental abundances in the crust generally parallels the cosmic abundance of the elements, but with two major exceptions. The first exception is that hydrogen and helium dominate the cosmos but are only 3 % of crustal atoms. The second is that sulfur and the elements that fall below it in the periodic table (selenium, tellurium, chromium, molybdenum, and tungsten) are depleted in the crust compared to their relative cosmic abundance.

6. Iron and nickel are anomalously abundant. For more on that, see the page on "Binding energy and elemental abundance".



Cosmic abundances are from Ahrens, L.H., 1965, *Distribution of the Elements in our Planet:* New York, McGraw-Hill, 110 p.;
Crustal abundances are from Krauskopf, K.B., 1979, *Introduction to Geochemistry* (2nd edn.): New York, McGraw Hill, 617 p.