Sources of information for
An Earth Scientist's Periodic Table of the Elements and Their Ions
(version 4.7)


Bismuth radioactive decay: de Marcillac, P., Coron, N., Dambier, G., Leblanc, J., and Moalic, J.-P., 2003, Experimental detection of $\alpha$-particles from the radioactive decay of natural bismuth: Nature, v. 422, p. 876-878. This paper provides the first direct evidence of alpha decay of $^{209}\text{Bi}$ to $^{205}\text{Tl}$, with a half-life of $2 \times 10^{19}$ years.


V in CAIs is the 2+ and 3+ states (Grossman, pers. comm, 2003). Valence states from W, Re, and U are inferred from those of V and Ti. CAIs are thought to be the first solids to have formed in the condensation of the solar nebula to form the solar system.

Contours of ionic potential: For each cell of the table, charge was divided by radius, the resulting value was written over the cell, and the resulting values were then contoured, much as one would contour a topographic map. The contours are thus not an interpretation but instead only a derivation of the charge and radius data.

Coordination chemistry: Stumm, W., and Morgan, J.J., 1981, Aquatic Chemistry (second edn.): New York, John Wiley and Sons, 780 p., and Stumm, W., and Morgan, J.J., 1996, Aquatic Chemistry (third edn.): New York, John Wiley & Sons, 1022 p. Stumm and Morgan give S>I>Br>Cl=N>O>F as the sequence of preferential coordination of soft cations; the sequence shown on the table (I>Br>S>Cl=N>O>F) is derived from the mineralogical patterns shown on the table and applies to the softest cations (e.g. Au+ and Hg+).


Ferromanganese nodules: Monget, J.M., Murray, J.W., and Mascle, J., 1976, A World-wide Compilation of Published, Multicomponent/analyses of Ferromanganese Concretions: NSF-IDOE Manganese Nodule Project Technical Report No. 12, ca. 173 p. Enrichment ratios relative to seawater were calculated; the ten cations with greatest enrichment are labeled on the table. No attempt was made to separate detrital contributions from authigenic hydroxenous contributions to overall nodule chemistry.


Mantle elemental depletion: Symbols for least depletion are shown for ions inside the "<2" contour of crustal enrichment on Figure 11.6 of Taylor, S.R., and McLennan, S.M., 1985, The Continental Crust: its Composition and Evolution: Oxford, Blackwell, 312 p. Note that not all cations of intermediate ionic potential are not depleted from the mantle; only those that can substitute for the major ions of mantle minerals (Mg$^{2+}$, Fe$^{2+}$, and Si$^{4+}$ fall in this group). Also see McDonough, W.F., and Rudnick, R.A., 1998, Mineralogy and composition of the upper mantle, in Hemley, R.J., ed., Ultrahigh-pressure Mineralogy: Reviews in Mineralogy Vol. 37, p. 139-164, and Sun, S-S., 1982, Chemical composition and origin of the earth's primitive mantle: Geochimica et Cosmochimica Acta, v. 46, p. 179-192.

Minerals: Clark, A.M., 1993, Hey's Mineral Index: London, Chapman and Hall, 852 p. Symbols are shown only for minerals of one cation and one anion (e.g., for Al2O3 and NaF, but not Na3AlF6 or AlF(OH)2).


Solubility of oxides of hard cations: Thermodynamic data are from Robie, R.A., Hemingway, B.S, and Fisher, J.R., 1979, Thermodynamic Properties of Minerals and Related Substances at 298.15 K and 1 Bar (105 Pascals) Pressure and Higher...