

HORIZONTAL ISOMORPHIC SUBSTITUTIONS OF CHEMICAL ELEMENTS

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Horizontal isomorphic substitutions of chemical elements is described.

2 figures, 4 references.

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According to position of elements in the Periodic table by D.I. Mendeleev, Fersman (1952–1959) distinguished 3 types of isomorphic substitutions (Fig. 1, 2): the most common vertical (Na-K-Rb), horizontal (Fe-Co-Ni) and diagonal (Ti-Nb, Ca-Y, etc.).

The horizontal isomorphic substitutions (Fig. 2) are the widest in the lanthanide group from La № 57 to Lu № 71. The neighbor elements intimately correlate, especially strongly in pairs even-odd lanthanide (for example, Ce and La). Odd lanthanide could be situated in the table to the left of even one (La to unstable Pm) and to the right of even one (Lu paired with Yb). In these seven pairs of lanthanides correlation is frequently caused by the fact that the major isotope of even element (for example, Nd has 7 isotopes)

agrees in respect of number of neutrons (82) with single isotope of odd coupled Pr. The agreement of number of neutrons in pair of heavy lanthanides, Dy – Ho (98), Yb – Lu (104), is similar. A shift of isotope spectrum Yb to Lu is characteristic.

Semenov (1976, 2001) and Galiulin (2007) published the Periodic table with indication of number of neutrons in the major isotope rather than mean atomic weight. Coincidence of number of neutrons of major isotopes in isomorphic pairs Mn-Fe (30), Cu-Zn (34, and for neighboring Ga, 38), Ru-Rh (58, and for neighboring "geochemically alien" Pd, 62) is characteristic. Pair Os-Jr (116) is similar. Horizontal heterovalent isomorphic substitution also is known in pairs Y-Zr ("magic" 50 neutrons) and Pb-Bi (126 neutrons). At vertical (Nb-Ta, Mo-W) and diagonal (Ti-Nb, Sc-Zr) isomorphic substitution, number of neutrons of heavy element is about 2 times more than that of light one (Ti – 26, Nb – 52). On schemes of vertical isomorphic substitutions the distance between vertical lines of related lithophilic and chaecophilic elements is minimal in the central 4th group.

The above data should be kept in mind to distinguish large geochemical groups of elements (s-, p-, d- and f-elements).

References

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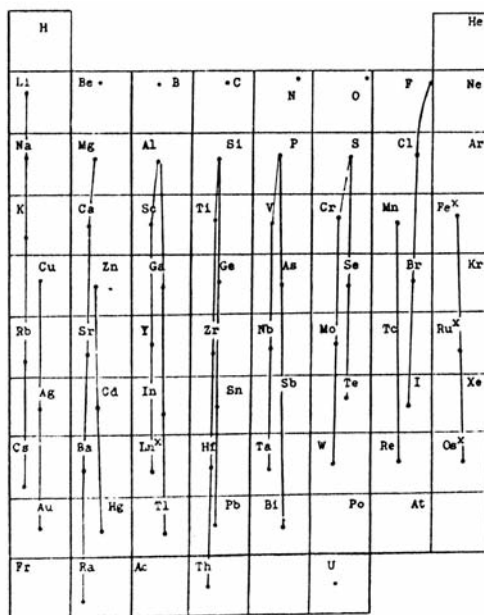


Fig. 1. Scheme of vertical isomorphic substitutions. In squares of the Periodic table are plotted dots according to coordinates: electronegativity of element (increases from left to right along diagonal from 0.7 – Cs to 4 – F) and its ionic radius (from top to bottom from 0.15 Å – N to 2.22 Å – Te).

Fe^x, Ru^x, Os^x, Ln^x are group of elements.

