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UNIQUE ASSOCIATION OF THALLIUM AND RUBIDIUM IN MINERALS

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Spectrochemical analyses of various minerals have shown that "alkali metal" thallium and rubidium are found only in potassium minerals and the cesium mineral pollucite, and that in these minerals the Tl:Rb association is very close. Altogether 167 specimens have been analyzed quantitatively, the selection comprising lepidolite, amazonite, hydrothermal pegmatitic microcline, primary pegmatitic microcline, zinnwaldite, biotite, muscovite, phlogopite, pollucite, rhodizite, and cesium beryl. The mean weight ratio $\%Rb_2O/\%Tl_2O$ was determined as 100, and the vast majority of the ratios fall within the limits of 35-300; the extreme limits are 10 and 650. A plot of $\log \%Rb_2O$ vs. $\log \%Tl_2O$ produced a curve of unit slope over the thousand fold range of concentration that could be investigated. There appears thus to be no shift in the ratio Rb/Tl throughout the selective crystallization of minerals and the ratio seems to be independent of the type of host mineral: the ratio does, however, vary to some extent from area to area, and it seems likely that the cause for this variation is a chemical one. The reasons for the close association of "alkali metal" thallium and rubidium are that the radii of their ions are identical and that in certain pertinent respects, their chemical properties are very similar.

With the possible exception of the pair Zr:Hi, which elements are very closely associated in minerals, "alkali metal" thallium and rubidium are perhaps the most closely associated pair of elements in the earth's crust, and their association is made more unique because thallium is a Group 3b element, whereas rubidium is an alkali metal (Group 1a).

The abundance of thallium in the earth's crust has been estimated as 0.0003% Tl, by weight.

WEATHERING OF PLAGIOCLASE FELDSPARS TO BAUXITE*

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In Oregon plagioclase feldspars weathered to kaolinite-halloysite or to beidellite-nonttronite; then, gibbsite and bauxite formed from these clay minerals by the removal of silica. Contrary statements in four recent publications subordinate this two-stage process: "that calcium feldspar gives free aluminum hydroxide," "that gibbsite precedes kaolin in the weathering of all but the most silicic igneous rocks," "that under tropical conditions laterite is developed from basic igneous rocks and clay from granitic rocks," and "that kaolinite is an insoluble hydrated silicate and the change ends with its formation."

A hole drilled by Alcoa into one Oregon ferruginous bauxite deposit indicates that weathering penetrated downward more than 175 feet with alumina, iron, titanium, and water increasing progressively but not regularly at the expense of silica. Alumina ranges from 47-25 per cent in the upper 50 feet to 35-24 in the underlying 100 feet, ferric oxide from 49-18 per cent to 32-15, titania from 8-3 per cent to 7-3; water from 25-13 per cent

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DISTRIBUTION OF OXYGEN IN THE LITHOSPHERE

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Oxygen, which makes up more than 90 per cent by volume of the total lithosphere, shows the highest concentration in the outer shell. The regular decrease with depth represents an approximation to thermodynamic equilibrium. When highly oxidized surface rocks are brought down to great depths, oxygen will be squeezed out of the mineral lattices and returned to the surface. Therefore the deeper parts of our globe are not able to become oxidized.

TYROLITE, HIGGINSITE AND CORNWALLITE

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X-ray and optical studies on numerous specimens of hydrated basic copper arsenates yield the following data:

Tyrolite: orthorhombic; probable space group *Pmma*; the unit cell with $a=10.50$, $b=54.71$, $c=5.59$ Å, $a:b:c=0.1919:1:0.1022$, contains $4[\text{Cu}_9\text{Ca}_2(\text{AsO}_4)_4(\text{OH})_{10}\cdot 10\text{H}_2\text{O}]$. Specific gravity, measured 3.27 (Hillebrand); calculated, 3.27. Optical characters; biaxial, negative, $X=b$, optic plane $\parallel (001)$. Crystals from Schwartz, Tyrol, are lath-like and elongated $\parallel a$; they contain microscopic spherical inclusions with a radiating structure. Crystals from Centennial Eureka Mine, Tintic, Utah, are elongated $\parallel c$. The unit cell dimensions, $a=10.34$, $b=26.9$, $c=5.57$ Å, given by Wolfe for "trichalcite" from Turginsk, suggest probable identity of "trichalcite" with tyrolite.

Higginsite: several specimens labelled "conichalcite" and "erinite" from Utah, Nevada, and Cornwall give identical x-ray powder patterns which prove to be identical with the pattern of higginsite from Bisbee, Arizona. A crystal of "erinite" from Utah is orthorhombic with probable space group *Pnam* and unit cell, $a=7.40$, $b=9.26$, $c=5.87$ Å. These elements agree well with the elements for higginsite given by Strunz (1939) and Richmond (1940).

Cornwallite: the identical x-ray powder patterns given by cornwallite from Cornwall and several specimens of "erinite" from Utah indicate probable isomorphous relationship of this mineral with pseudomalachite. The name cornwallite is retained for this mineral.

THE SYSTEM $\text{MgO-SiO}_2\text{-H}_2\text{O}$

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The system has been investigated up to 900°C. and 30,000 lbs./in.² Four-phase P-T curves have been determined showing equilibrium relations between the vapor (or fluid) phase and the crystalline phases serpentine, talc, forsterite, enstatite, and silica. No liquid phase has been encountered, a fact that is suggestive in connection with the problem of the existence of "serpentine magma" in the pressure-temperature range investigated.

ROLE OF TEMPERATURE IN MINERALOGY

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Temperature endows a mineral with energy beyond that of its static crystal structure. This excess energy is the cause of many well-known mineralogical relationships, which can be comprehended as transformations.

Three different structural changes may occur in the transformation of one crystalline