CRYSTAL CHEMISTRY OF TALC: CHEMICAL STUDY

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The present work was based both on published data on talcs and on our own talc analyses. The total number of chemical analyses of talcs exceeded 120. Chemical compositions of talc show various elements, such as Fe, Al, Cr, Ni, Mn, alkalies and fluorine. Several analyses of talcs from Egypt (El-Sharkawy, 2000) show the rectilinear negative correlation of Si and Fe^{3+} suggesting simultaneous substitution of Fe^{3+} both in tetrahedra and in octahedra according to the mechanism MgSi ↔ $Fe^{3+}Fe^{3+}$. This was verified in talcs deficient in Si and rich in Fe. Essentially better calculated formulas and agreement of the layer charge with the theoretical value 22 were achieved after recalculation of Fe oxidation state according to the above mentioned scheme (Fig. 1). The highest Fe^{3+} contents demonstrate talcs from low-temperature crystallisation environments. The likely explanation is interaction with pore fluids.

Chemical compositions of octahedral sheet, plotted in the ternary diagram Mg-Al-Fe+Mn+Ni+Zn, demonstrate a quite regular grouping of projection points into three fields: I) near-stoichiometric talcs around 100% Mg; II) talcs with elevated Fe+Mn+Ni+Zn contents and III) Mg-Al talcs. Samples representing all genetic types gather in the first field, in the second dominate talcs from high pressure and ultramafic environments, and in the third dolomite related talcs (Fig. 2).

The positive correlation of tetrahedral Al and Na (R^2 = 0.71) suggests the substitution mechanism involving the tetrahedral sheet and interlayer space: NaAl ↔ Si (Fig. 3). Much weaker correlation shows octahedral Al (R^2 = 0.50). Sodium content shows positive correlation both with temperature and pressure of talc crystallisation. It is likely that high PT conditions favour incorporating Na into the talc structure.

No correlation was observed between chemical composition and structural varieties of talc, expressed as the presence or absence of structural and/or superstructural diffractions in powder diffraction patterns.

Reference

EL-SHARKAWY, M. F. (2000): Mineralium Deposita, **35**, 346–363.

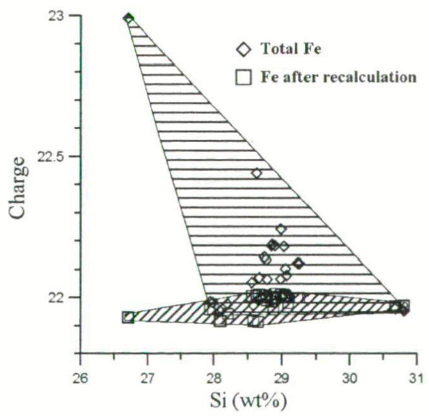

Fig. 1

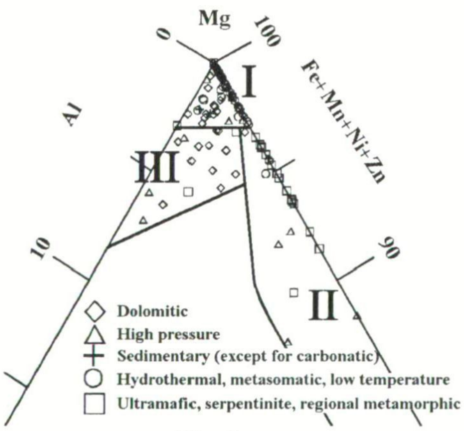

Fig. 2

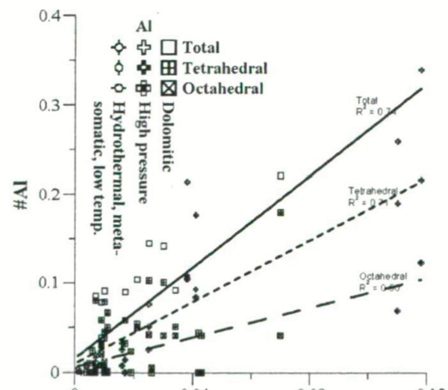

Fig. 3