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Comments on 'Cements in radioactive waste disposal: some mineralogical considerations'

IN explaining the Cs uptake behaviour of tobermorites, McCulloch *et al.* (1985) misquoted our paper (Komarneni *et al.*, 1982) on the cation exchange of tobermorites. These authors state on p. 217 of their paper as follows: 'This explanation is contrary to that advanced by Komarneni *et al.* (1982) who reported that the presence of Al in the structure was essential for Cs uptake. They suggested that during the synthesis $\text{H}_3\text{O}^+ + \text{Al}^{3+}$ substitute for Si^{4+} , subsequent Cs uptake occurring by Cs^+ for H_3O^+ exchange.' We have not suggested the incorporation of $\text{H}_3\text{O}^+ + \text{Al}^{3+}$ for Si^{4+} in our paper. In fact, Komarneni *et al.* (1982) contradicted the above substitution mechanism proposed by Kalousek (1957) and we wrote (p. 774) 'In contrast we report here that the Al-substituted tobermorite incorporates cations other than protons within its layer structure to maintain electrical neutrality and these cations are exchangeable analogous to the smectite and vermiculite clay minerals.'

Since our 1982 paper we have published several other papers (Komarneni and Roy, 1983a; Komarneni and Roy, 1983b; Komarneni *et al.*, 1984) which more fully explain the role of a coupled

Na + Al substitution for Si in tobermorite on its alkali cation exchange and Cs selectivity properties. It is regrettable that McCulloch *et al.* overlooked the above pertinent literature. When tobermorites undergo substitution of Si by Al in the absence of alkalis, the charge must be balanced by the substitution of Ca^{2+} ions in the structure. These hydrated Ca^{2+} ions are too large to be exchanged from the interlayer positions. Thus tobermorites substituted with Al alone do not exhibit high alkali exchange and Cs selectivity (Komarneni and Roy, 1983a) for steric reasons.

Both the Al-free and Al-substituted tobermorites have similar alkali exchange only when the alkalis are not present during their synthesis (Komarneni and Roy, 1983a). The presence of alkalis in the tobermorite structure is essential for high alkali cation exchange capacity and Cs selectivity for steric reasons.

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