The Canadian Mineralogist
Vol. 43, pp. 1123-1124 (2005)

DERIVATION OF A NEW GLADSTONE–DALE CONSTANT FOR VO_2

JOSEPH A. MANDARINO[§]

94 Moore Avenue, Toronto, Ontario M4T 1V3, Canada

In connection with a proposal to the Commission on New Minerals and Mineral Names of the International Mineralogical Association for a new mineral containing V^{4+}, the chairman of that commission remarked that the Gladstone–Dale compatibility index (CI) is poor, as it is for two other species containing VO_2. This prompted the author to re-examine the derivation of that constant. At the time the value of 0.393 was published, 1976, there were few published descriptions of minerals containing V^{4+} that had sufficient data from which to derive a Gladstone–Dale constant for VO_2. In Table 1, the number of species described before 1976 and after 1976 is listed The author does not remember which of the seven datasets available before 1976 were used to derive the VO_2 constant or if it was extrapolated or interpolated from other RO_2 data. Reference to Mandarino (1978) indicates that the 0.393 value may have been assigned by similarity to the constants for MnO_2 (0.394), CrO_2 (0.394) and TiO_2 (0.393). However, a new derivation was undertaken using the 16 complete sets of data, and the results are given in Table 2. It is clear that the *k* with a value of 0.393 was *not* derived from any of the species listed.

The *k* values listed in Table 2 vary considerably, from 0.203 to 0.326, which is not unusual for a constituent such as this. The mean of the 16 values is 0.252; if the highest and lowest values are ignored, the mean of the remaining 14 values is 0.259, and if the two highest and lowest values are ignored, the mean of the remaining 12 values is 0.249. With such a near-Gaussian distribution, if all the values except the two "middle" values are ignored, the mean of those two is 0.253, which is almost exactly the same as the mean of all 16 values.

The final test of this constant is to calculate the compatibility index of all 16 species. The results are given in Table 3, where the species are listed in the same order as in Table 2. Thus, there are six superior, four excellent, two good, one fair and three poor, which is a reasonable distribution for species of this sort. Note that pauflerite (Krivovichev *et al.*, submitted), which started this review of the VO_2 constant, is still in the poor category.

TABLE 1. NUMBER OF SPECIES WITH VO_2 DESCRIBED PRE- AND POST-1976

Period of publication	Species with complete data	Species with incomplete data	Total species
Pre-1976	7	11	18
Post-1976	9	5	14
totals	16	16	32

TABLE 2. VALUES OF k VO_2 FOR SIXTEEN SPECIES WITH COMPLETE SETS OF DATA, ARRANGED IN INCREASING ORDER OF *k*

Species	*k* VO_2	Data*	Species	*k* VO_2	Data*
haradaite	0.203	post	suzukiite	0.253	post
stanleyite	0.212	post	bobjonesite	0.255	post
sincosite	0.215	pre	minasragrite	0.256	pre
pentagonite	0.220	pre	anorthominasragrite	0.259	post
lenoblite	0.221	pre	duttonite	0.277	pre
watatsumiite	0.245	post	simplotite	0.284	pre
bariosincosite	0.247	post	pauflerite	0.299	post
orthominasragrite	0.253	post	cavansite	0.326	pre

* Data used: pre- or post-1976?

TABLE 3. VALUES OF THE COMPATIBILITY INDEX $1 - (K_p/K_c)$ FOR SIXTEEN VO_2-BEARING SPECIES USING $k = 0.252$ FOR VO_2

Species	C.I.	Category	Species	C.I.	Category
haradaite	0.033	excellent	suzukiite	0.012	superior
stanleyite	0.051	good	bobjonesite	-0.005	superior
sincosite	0.081	poor	minasragrite	0.004	superior
pentagonite	0.025	excellent	anorthominasragrite	-0.013	superior
lenoblite	0.088	poor	duttonite	0.074	fair
watatsumiite	0.009	superior	simplotite	-0.058	good
bariosincosite	0.016	superior	pauflerite	-0.114	poor
orthominasragrite	-0.022	excellent	cavansite	0.026	excellent

C.I.: compatibility index.

§ *E-mail address*: j.a.mandarino@sympatico.ca

Acknowledgement

The interest and encouragement of Ernst A.J. Burke, Chairman of the Commission on New Minerals and Mineral Names of the International Mineralogical Association are gratefully acknowledged.

References

Mandarino, J.A. (1976): The Gladstone–Dale relationship. I. Derivation of new constants. *Can. Mineral.* **14**, 498-502.

_____ (1978): The Gladstone–Dale relationship. II. Trends among constants. *Can. Mineral.* **16**, 169-174.

Received February 7, 2005.