The Canadian Mineralogist
Vol. 40, pp. 1211-1213 (2002)

"LYNDOCHITE" REVISITED: A CAUTIONARY NOTE ON DISCREDITATIONS

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Abstract

An *avoidable* compounding of procedural and conceptual errors led to the generally held yet erroneous conclusion that "lyndochite" is equivalent to aeschynite-(Y). Instead, "lyndochite" is a minor chemical variety of euxenite-(Y), a conclusion reinforced by modern anecdotal and scientific evidence.

Keywords: "lyndochite", euxenite group, aeschynite group, granitic pegmatite, discreditation, Quadeville beryl mine, Renfrew County, Ontario.

Sommaire

Des erreurs procédurales et conceptuelles composées qui auraient bien pu être évitées ont mené à la conclusion que la "lyndochite" est synonyme de l'aeschynite-(Y). Au contraire, la "lyndochite" serait une variante de l'euxenite-(Y), selon l'évidence anecdotique et scientifique moderne.

Mots-clés: "lyndochite", groupe de l'euxénite, groupe de l'aeschynite, pegmatite granitique, discréditation, mine de béryl de Quadeville, comté de Renfrew, Ontario.

Introduction

Ellsworth (1927) described samples of a thorium-rich euxenite-group mineral from a granitic pegmatite dike on lot 23, concession XV of Lyndoch Township, Renfrew County, Ontario (Quadeville Beryl mine, Ercit 1994). He assigned the mineral new species status, calling it "lyndochite", presumably after the broad geographic locality, *i.e.*, Lyndoch Township. Butler (1957) re-examined "lyndochite" and found different distributions for the lanthanon and actinide elements than Ellsworth (1927), and concluded that the analytical results of Ellsworth (1927) were in error. Second and third occurrences of the mineral with compositions similar to those of Butler (1957) were found in China (Gorzhevskaya & Sidorenko 1962) and Kenya (Horne & Butler 1965). Horne & Butler (1965) found euxenite-(Y) and columbite associated with samples from Lyndoch Township, and proposed that the discrepancy between their analytical results, which amounted to a reworking of the data of Butler (1957), and those of Ellsworth (1927), could be due to impurities in the material of Ellsworth (1927). The last definitive work on "lyndochite" was written by Fleischer (1966), who, using the analytical data of Butler (1957), proposed that it is identical to aeschynite-(Y).

Analysis

The case of "lyndochite" provides excellent insights into mistakes that can easily be made in the discreditation of mineral species. The seemingly reasonable and logical conclusion ultimately reached by Fleischer (1966) is flawed by unintended bias and a historical compounding of conceptual errors. Here is a brief analysis of how the conclusion "lyndochite" = aeschynite-(Y) was reached.

Procedural error: type material was not used in the re-investigations

Butler (1957) did not examine the type material of Ellsworth (1927), but instead examined material apparently from the type locality, but collected by a third party, J.E.T. Horne (Butler 1957). The two batches of samples differed in ways that Butler (1957) might have regarded as important; *e.g.*, the samples of Ellsworth (1927) were typically indexable "excellent crystals", whereas the samples of Butler (1957) "exhibited no faces".

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Conceptual error: discrepant results are due to analytical errors

In finding that his results were different from those of Ellsworth (1927), Butler (1957) concluded that the discrepancy was attributable to the chemical analytical work. Butler (1957) did not consider the possibility that his material and the type material were different.

Conceptual error: when in doubt, blame the other guy

When he concluded that the discrepancy was due to an analytical error, Butler (1957) assumed that the original analytical data of Ellsworth (1927) were "not wholly correct".

Conceptual error: our plight was our predecessor's downfall

When Horne & Butler (1965) surmised that their material is a mixture of aeschynite-(Y), euxenite-(Y) and columbite, they concluded, "There is no means of knowing if the material Ellsworth (1927) used was pure lyndochite, but the discrepancies between his and later work suggest that it was admixed with the associated euxenite". However, Ellsworth (1927) used euhedral crystals and went to great pains to hand-pick any visible impurities from his crushed concentrate, whereas Butler (1957) admitted that he did not separate impurities. [Note that the quoted "later work" was the work of Butler (1957), from which the analytical data for Horne & Butler (1965) were derived.]

Conceptual error: there is safety in numbers

When Horne & Butler (1965) found that samples they identified as "lyndochite" from Kenya were compositionally close to their sample from the type locality, they somewhat circularly concluded that their suspicions about "lyndochite" were correct: "The uncertainty still surrounding lyndochite from the type locality makes it all the more fortunate that another example, uncomplicated by mineral intergrowths, has been found in Kenya".

Conceptual error: newer is better

Faced with the discrepant results of Ellsworth (1927) and Butler (1957), Fleischer (1966) based his taxonomic arguments exclusively on the newer and somewhat more complete analyses of Butler (1957), completely ignoring the analytical work of Ellsworth (1927).

Other errors of interpretation exist in Horne & Butler (1957); nonetheless, even from the above, it can be seen that the conclusion "lyndochite" = aeschynite-(Y) is not convincingly proven.

Modern Context and Conclusion

There is some modern anecdotal and scientific evidence to support the early work and conclusions of Ellsworth (1927).

The type locality, the Quadeville Beryl mine, is a mineral locality visited regularly by many groups of mineral collectors and university students. Excellent euhedral crystals of "lyndochite" from the locality are still routinely obtained by collectors, attesting to the unusual nature of the anhedral samples collected by J.E.T. Horne (cited in Butler 1957). Furthermore, the morphological data of Ellsworth (1927) indicate that "lyndochite" is a member of the euxenite group; its morphology is not characteristic of members of the aeschynite group.

To date, I have only found "lyndochite" samples similar in chemical composition to those of Ellsworth (1927) in three separate collecting trips to the Quadeville Beryl mine, in the entire "lyndochite" holdings of the Canadian Museum of Nature, and in one "lyndochite" sample borrowed from the Royal Ontario Museum (M17214). The composition of the relatively unaltered sample M17214 is given in Table 1. The analytical method and operating conditions were essentially those of Ercit (1994). The sample is similar enough to the composition of the type material to leave no doubt that the original analytical work of Ellsworth (1927) was done correctly, and that the samples of Ellsworth (1927) and Butler (1957) are significantly different. Perhaps the

TABLE 1. CHEMICAL COMPOSITION OF "LYNDOCHITE", QUADEVILLE BERYL MINE, ONTARIO

	Ellsworth (1927)	This Study	Horne & Butler (1965)		Ellsworth (1927)	This Study	Horne & Butler (1965)
Na_2O	–	0.23	–	Tm_2O_3	–	0.00	0.17
MgO	0.13	0.00	–	Yb_2O_3	–	1.95	0.4
CaO	4.86	4.83	3	Lu_2O_3	–	0.35	0.06
MnO	0.59	0.62	–	$Y^*_2O_3$	18.22	(17.22)	(8.42)
FeO	0.77	1.07	0.75	$Ce^*_2O_3$	4.34	(3.46)	(12.64)
PbO	0.35	0.00	–	SiO_2	0.07	0.00	–
Al_2O_3	0.13	0.00	–	TiO_2	16.39	15.39	19.1
Sc_2O_3	–	0.04	–	ZrO_2	0.04	0.00	–
Fe_2O_3	1.32	–	–	SnO_2	0.12	0.00	–
Y_2O_3	–	11.58	4.42	ThO_2	4.95	5.47	10.77
La_2O_3	–	0.00	0.50	UO_2	0.67	0.98	–
Ce_2O_3	–	0.98	4.42	UO_3	0.04	–	–
Pr_2O_3	–	0.24	0.55	U_3O_8	–	–	0.4
Nd_2O_3	–	1.55	5.68	Nb_2O_5	41.43	44.56	–
Sm_2O_3	–	0.69	1.49	Ta_2O_5	3.84	2.30	–
Gd_2O_3	–	1.10	1.83	$Nb^*_2O_5$	(45.26)	(46.86)	42.50
Tb_2O_3	–	0.00	0.17	H_2O+	1.90	–	–
Dy_2O_3	–	1.15	0.99	H_2O-	0.06	–	–
Ho_2O_3	–	0.00	–	LOI	–	–	2.1
Er_2O_3	–	1.09	0.38	Total	100.22	96.17	99.68

$Y^*_2O_3 = Y_2O_3$ + HREE; $Ce^*_2O_3$ = LREE; $Nb^*_2O_5 = Nb_2O_5 + Ta_2O_5$. The compositions are reported in wt.%. "–": not measured or not detected; values in parentheses are calculated.

most significant difference is in the *LREE* content, one of three critical variables for discriminating "euxenite", "aeschynite" and "polycrase" (Ewing 1976). The canonical discriminant model of Ewing (1976) indicates that the sample of Ellsworth (1927) is euxenite-(Y) and the sample of Butler (1957) is aeschynite-(Y). I conclude that "lyndochite" is a thorian variety of euxenite-(Y); apparent "lyndochite" samples from other localities are likely misidentified as aeschynite-(Y).

Acknowledgements

The author thanks Dr. Robert I. Gait, formerly of the Royal Ontario Museum, for the loan of "lyndochite" sample M17214.

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Receiced July 13, 1999, revised manuscript accepted June 22, 2002.