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NEPTUNITE: UNIT CELL AND X-RAY POWDER DATA

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Prior to the publication of the "Catalogue of *x*-ray diffraction patterns and specimen mounts on file at the Geological Survey of Canada" (Sabina & Traill, 1960) no record of the *x*-ray powder pattern for neptunite ($Na_2FeTiSi_4O_{12}$) was available in the literature. The purpose of this note is to record the pattern together with indexing based on a redetermination of the unit cell dimensions.

A small prism of neptunite (0.2 mm × 1 mm long) from San Benito Co., California yielded the following dimensions from single crystal films:

	Rotation $CoK\alpha = 1.7902$	Weissenberg $CoK\alpha = 1.7902$	Precession $MoK\alpha = 0.7107$
d (100)	—	14.87Å	—
a	—	—	16.7Å
b	—	12.44	12.4
c	10.01Å	—	10.0
d (110)	—	9.56	—
β	—	—	115° 44′

and the following systematic extinctions:

hkl present only with $h + k = 2n$

*h*0*l* present only with $h = 2n$ and $l = 2n$

*h*00 present only with $h = 4n$

of which the first two lead to the space group $C2/c$ (15). This data is in substantial agreement with that given by Gossner & Mussgnug (1928):

$a = 16.57$ Å, $b = 12.67$, $c = 10.06$, $\beta = 115°\ 38'$

space group $C2/m$ or $C2/c$

The x-ray powder pattern (Table 1) gives average data taken from three diffractometer charts. (Cu$K\alpha$ = 1.54050, Ni filter). For one recording powdered crystal quartz (Herkimer N.Y.) was mixed with the neptunite sample as an internal standard. This powder data is more complete than that given by Sabina & Traill (1960) or by Heinrich & Quon (1963). The strong lines are in good agreement except for the second strongest line at d = 9.6 which is missing in the earlier patterns obtained with copper radiation and film methods. This line is readily observed on films taken with Co or Fe radiation and a 114.59 mm diameter camera.

The powder spacings were indexed using the cell dimensions noted above. Indices not represented by medium to strong reflections on the single crystal films were discarded. The following cell dimensions were obtained from the indexed powder spacings: a = 16.46 Å, b = 12.50, c = 10.01, β = 115° 26½′.

Table 1. Neptunite, X-ray Powder Pattern
(Diffractometer Cu$K\alpha$ = 1.5405, Ni filter)
a = 16.46 Å, b = 12.50, c = 10.01, β = 115° 26½′

d Å	*I*	*hkl*	*d* Å	*I*	*hkl*
9.6	60	110	*2.401	8	ni
7.75	14	$\bar{1}11$	2.390	8	440
5.84	6	111	2.333	6	151
*{4.83	10	201,$\bar{2}21$	2.308	12	712
{4.79	12	220	2.274	6	$\bar{3}51$
4.60	4	$\bar{1}12$	2.260	6	004,$\bar{7}11$
4.51	10	002	2.229	4	$\bar{1}52$
4.012	6	130	2.212	4	$\bar{7}13$
3.837	20	$\bar{1}31$	*2.206	4	$\bar{4}43$?
3.708	6	200	2.166	30	$\bar{4}51$,043
3.517	45	131	*2.099	10	152
3.308	35	$\bar{3}31$	2.090	10	710
3.186	100	$\bar{1}32$	2.079	10	$\bar{6}24$
3.093	16	$\bar{5}12$	2.069	10	$\bar{1}34$
3.029	12	$\bar{3}32$	2.056	12	$\bar{8}02$
2.942	32	$\bar{2}23$	2.043	8	621,$\bar{6}41$
2.899	30	222	2.006	14	260
2.891	30	510,$\bar{2}41$	1.986	14	$\bar{5}51$,$\bar{3}53$
2.837	32	132	1.966	8	$\bar{5}52$
2.775	10	331	1.936	6	640
2.734	18	$\bar{5}13$	1.917	14	$\bar{2}62$
2.637	4	$\bar{2}42$	1.912	20	
*2.590	4	$\bar{3}33$?	1.893	4	
2.554	12	$\bar{1}33$	1.87	6 *b*	
2.493	24	$\bar{6}22$	1.765	6	
2.480	32	$\bar{6}21$	1.757	8	
2.446	8	$\bar{3}14$	1.691	8	
2.407	8	$\bar{4}42$	1.682	8	

*Resolved on one chart only.

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BOOK REVIEW

ZUR GEOCHEMIE UND LAGERSTÄTTENKUNDE DES URANS (The Geochemistry and Economic Geology of Uranium) by J. Dybeck, *Clausthaler Hefte zur Lagerstättenkunde und Geochemie der Mineralogischen Rohstoffe, Heft 1, 1962.* Gebr. Borntraeger, Berlin, 163 pages. Price: DM 45 (by subscription), DM 50 (purchased individually). In German.

This is the first of the "Clausthaler Hefte", a series which, according to the editor's introduction, is dedicated to problems bearing on the origin of mineral deposits. The publishers plan to devote subsequent issues to other minerals of economic interest, the next one to deal with the origin of marine-sedimentary iron ores.

The emphasis in this volume is primarily on the geochemistry of uranium rather than on its economic geology, at least in the sense in which the term economic geology is used on this continent. Specific deposits are mentioned as examples to illustrate the geochemical discourse, and there are consequently no really detailed accounts of the geology of any one deposit. This volume is evidently not intended for the reader who wishes to obtain specific details about the geology or mineralogy of a particular deposit, but rather for one who wishes a relatively up-to-date review of geochemical facts and theories on uranium mineralization. The writer has drawn on an extensive bibliography dated as late as 1960. The subject-matter is well organized and the discourse is quite easy to follow (to the reader familiar with German, that is).

The number of pages devoted to the major subdivisions in the book are as follows:

Physical and Chemical Properties of Uranium	28
Mineralogy of Uranium	8
Uranium in Cosmic Differentiation	6