

oxidising free carbon and apparently converting ϵ -FeOOH to hematite.

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KEYWORDS: ϵ -FeOOH, shale, Pilbara, Western Australia.

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Powder X-ray diffraction data of rossite

In a review of the literature for the Mineral Powder Diffraction File by Bayliss *et al.* (1980), powder X-ray diffraction data could not be found of the mineral rossite, $\text{CaV}_2\text{O}_6 \cdot 4\text{H}_2\text{O}$. With the crystal structure parameters of rossite determined by

Ahmed and Barnes (1963), a powder X-ray diffraction pattern was calculated with the programme of Langhof, Physikalische Chemie Institute, Darmstadt. Since the powder data of synthetic $\text{CaV}_2\text{O}_6 \cdot 4\text{H}_2\text{O}$ prepared by Kovgan and Nakhodnova

TABLE I. Powder X-ray diffraction data of rossite

<i>hkl</i>	<i>d</i> _{calc}	<i>d</i> _{obs}	<i>I</i> / <i>I</i> ₁	<i>I</i> _{calc}	<i>hkl</i>	<i>d</i> _{calc}	<i>d</i> _{obs}	<i>I</i> / <i>I</i> ₁	<i>I</i> _{calc}
100	7.249	7.260	90	87	$\bar{2}03$	2.290	2.287	5	5
$\bar{1}10$	6.630	6.636	95	100	130	2.223	2.224	3	1
001	5.999	6.017	50	53	$\bar{3}30$	2.210	2.209	10	3
110	4.578	4.599	10	13	031	2.149	2.148	15	9
020	3.927	3.934	25	26	$\bar{2}23$	2.134	2.132	5	3
$\bar{2}10$	3.853	3.860	100	86	$\bar{2}13$	2.109	2.111	5	3
$\bar{1}02$	3.430	3.432	60	12	$\bar{1}40$	2.092	2.092	25	14
$\bar{1}12$	3.428				$\bar{3}13$	2.090	2.092	25	
$\bar{2}20$	3.315	3.320	25	17	$\bar{2}32$	2.077	2.077	10	5
012	3.182	3.186	3	6	$\bar{2}22$	2.062	2.061	5	5
$\bar{2}21$	3.128	3.127	6	7	313	2.042	2.038	3	4
$\bar{1}20$	3.031	3.033	55	37	040	1.964	1.965	3	5
$\bar{2}12$	3.022				420	1.9266	1.9266	10	8
002	2.999	3.000	50	33	$\bar{4}12$	1.9158	1.9155	5	9
$\bar{2}10$	2.920	2.921	40	6	$\bar{2}41$	1.9056	1.9046	15	7
$\bar{1}12$	2.919				340	1.8873	1.8871	25	7
$\bar{1}22$	2.916	2.916	16	11	$\bar{1}23$	1.8540	1.8581	2	3
$\bar{2}11$	2.817				411	1.8451	1.8447	2	5
130	2.801	2.804	15	12	230	1.8353	1.8332	3	4
131	2.723	2.725	6	5	320	1.7932	1.7941	5	5
302	2.609	2.613	15	12	432	1.7767	1.7755	8	6
310	2.582	2.586	20	14	$\bar{2}14$	1.7568	1.7564	25	14
312	2.546	2.550	10	5	311	1.7283	1.7275	10	5
122	2.516	2.520	6	4	032	1.7079	1.7089	12	6
$\bar{2}22$	2.432	2.431	15	15	124	1.6935	1.6926	10	9
311	2.421	2.420	25	9	250	1.6749	1.6749	10	7
032	2.417				251	1.6715	1.6706	10	4
300	2.416	2.375	5	8	312	1.6483	1.6472	5	7
$\bar{2}31$	2.376				214	1.6044	1.6039	12	4
$\bar{1}32$	2.341	2.342	10	4	350	1.6030	1.6030	12	3
$\bar{1}13$	2.312	2.309	15	6	$\bar{4}14$	1.5878	1.5868	10	1
121	2.307				152	1.5625	1.5618	10	5

(1973), with six reflections (PDF 30-287), has many strong reflections missing compared with the calculated pattern, it was decided to collect powder data.

Specimen number 20292 of the American Museum of Natural History, New York, from Yellow Cat Wash, near Thompsons, Utah, USA was reported to contain rossite together with metarossite, $\text{CaV}_2\text{O}_6 \cdot 2\text{H}_2\text{O}$. A powder X-ray diffraction pattern of specimen 20292 was identified as only metarossite after comparison with PDF 29-392. Specimen 20292 was then placed over water in a dessicator for three months at room temperature, where the specimen rehydrated to rossite. Therefore the reaction between rossite and metarossite is reversible at room temperature.

Guinier films of rossite were taken with $\text{Cu-K}\alpha_1$ radiation (1.5405 Å) with a graphite 0002 monochromator for 2 and 14 hour exposures, and then measured with a densitometer. The unit-cell para-

meters, which were refined by least-squares analysis starting from the unit-cell parameters of Ahmed and Barnes in space group $\text{P}\bar{1}$ (no. 2), are a 8.552(2), b 8.576(2), c 7.028(2) Å, α 101.50(2)°, β 114.96(2)°, and γ 103.39(2)°. The hkl , d calculated, d observed, relative intensities (I/I_1), and I calculated are presented in Table I.

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Some alumina and silica in weathered ilmenite grains is present in clay minerals—a response to Frost *et al.* (1983)

IN a recent issue of this journal, Frost *et al.* (1983) reported electron microprobe analyses of altered ilmenite grains from West Australian beach sand deposits which they interpreted as showing that Al and Si levels increased with decreasing iron within those grains whose compositions lie between that of rutile and pseudorutile. These authors consider that during the latter stages of ilmenite alteration, when rutile crystallizes from solution, both alumina and silica are extracted from the ambient environment and are coprecipitated with, or adsorbed on, rutile. However, in the lateritic pallid zone, the increased Al and Si content of altered ilmenite grains is due to crystallization of halloysite, kaolinite and gibbsite from soil solution within pores rather than to incorporation of these elements into anatase crystals (Anand and Gilkes, 1984).

In view of the apparent difference in forms of Al and Si in altered ilmenite from the pallid zone and beach sand, samples of ilmenite from West Australian beach sand were investigated using the analyti-

cal procedures employed by Anand and Gilkes (1984). The samples studied were from the same deposits as those analysed by Frost *et al.* (1983) and were supplied by Associated Minerals Consolidated (AMC), Capel, Western Australia. A chemical analysis of a typical altered ilmenite concentrate is given in Table I and is similar to samples investigated by Frost *et al.* (1983), although containing more TiO_2 and 2-3 times as much Al_2O_3 . Highly altered ilmenite grains were separated in a Frantz isodynamic magnetic separator and hand-picked under the microscope. A powder X-ray diffractometer pattern showed that the sample consisted of ilmenite, pseudorutile and rutile; no reflections due to clay minerals were detected. Reflected light photomicrographs of polished sections showed that partly altered ilmenite grains consist of a core or bands of dark grey phase (pseudorutile) with rutile showing white internal reflections developed within and around the grains. This style of alteration of ilmenite to rutile via pseudorutile in beach