pores within a rutile matrix. As massive ilmenite alters isovolumetrically with porous rutile, the increased abundance of pores allows for increased incorporation of Si and Al within the pores. Whereas Frost *et al.* propose that the Si and Al are coprecipitated with, or adsorbed on to the alteration products during the formation of rutile, we propose that the incorporation of these impurities in the pores of the altered grains is an integral, ongoing part of the soil-forming processes in the heavy mineral deposits. Thus incorporation of Al or Si into altered ilmenite grains in mineral sand deposits is identical to the mechanism proposed by Anand and Gilkes (1984) for altered ilmenite grains in lateritic pallid zones. This is a significant result, since existing methods of beneficiating the altered ilmenite ore are based on the assumption that Al or Si impurities are incorporated into rutile and anatase. Since most Al and Si is actually present as discrete clay minerals and gibbsite, they may therefore be removed by caustic leaching procedures that do not dissolve the titanium oxides.*

The West Australian mineral sand deposits

* Dr Grey has now kindly supplied sub-samples of altered ilmenite specimens YE-90 and YE-150 described in Frost *et al.* (1983). Both specimens were examined using the procedures described in this communication and were found to contain gibbsite, kaolinite, and halloysite.

are soils which have developed on ancient strand lines and it is reasonable to suppose that similar soil-forming processes (e.g. clay mineral and gibbsite crystallization) should operate here and in the lateritic pallid zone. However, the weathering environment is not identical in both soils since anatase and rutile are the major alteration products in pallid zones and beach sands respectively. This difference may be a consequence of a difference in the height of the water table and its effect on Eh and the mobility of Fe and other ions. For example, Schossberger (1942) has shown that the presence of SO_3 favours the formation of anatase instead of rutile.

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Note on cell parameters of zaherite

THE *hkl*-indices for the X-ray diffraction spectrum of zaherite was recently calculated for material from Pofadder, South Africa (Beukes *et al.*, Table II, 1984), using the method of Appleman *et al.* (1972). The authors have now become aware that the calculated cell volume is about 30 % too small. This becomes apparent when a formula is employed

which relates volume and density to the cation cell content (D. Peacor, pers. comm. 1984). We have now been successful in obtaining more refined indices (Table I) which are in agreement with the predicted cell volume. The revised cell parameters, with the standard errors given in parentheses, are: $a = 18.475$ (0.942), $b = 19.454$ (0.591), $c = 3.771$

TABLE I. X-ray powder pattern of zaherite

hkl	I	d obs	d calc	hkl	I	d obs	d calc
100	100	18.12	18.21	$\bar{2}$01	2	3.49	3.48
				340			3.48
020	5	9.56	9.55	510	1		3.47
200	4	9.08	9.11	530	2		3.42
120			9.10	$\bar{1}$60	8	3.22	3.23
$\bar{3}$10	1	5.52	5.52	$\bar{5}$20			3.23
140	6	4.82	4.82	060	2	3.18	3.18
330			4.82	$\bar{2}\bar{4}$1	1	3.03	3.03
410	8	4.61	4.61	$\bar{3}$21			3.03
240	4	4.56	4.55	$\bar{4}$11	1	2.97	2.96
400			4.55	630	1	2.94	2.94
$\bar{1}$40	4	4.44	4.44	700	1	2.60	2.60
$\bar{4}$10	1	4.22	4.24	43$\bar{1}$	1	2.59	2.59
$\bar{3}$30	1	4.08	4.07	$\bar{2}$51			2.59
430	1	4.03	4.04	$\bar{5}\bar{4}$1	1	2.22	2.22
				670			2.22
101	1	3.67	3.67	560			2.22
$\bar{1}$50	4	3.61	3.62	810			2.22
520			3.61	61$\bar{2}$	1	1.62	1.62
440			3.61	$\bar{2}\bar{7}$2			1.62
$\bar{1}$11	2	3.54	3.54	632			1.62
				442			1.62

Operating conditions: 40 kV, 20 mA; 1° 2θ/min. scan speed; ½ inch/min. chart speed;

Cu K$_\alpha$ radiation, λ = 1.54178 Å. Intensities estimated visually.

(0.231) Å, $\alpha = 95°$ 14.40′ (1° 6.60′), $\beta = 91°$ 28.80′ (2° 7.38′), $\gamma = 80°$ 14.40′ (1° 9.24′), $V = 1330.10$ Å^3 (8.27).

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