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RESEARCH NOTE

XRD STUDY ON CASSITERITE FROM BASTAR DISTRICT, M.P.

Abstract: Cassiterite occurs as discrete crystals, disseminations and occasionally as small veinlets mainly in the quartz core, in the tin-bearing rare-metal pegmatites of Bastar disttrict, M.P. XRD study on it reveals that columbite-tantalite occurs possibly in solid solution with it resulting in decrease of its axial lengths of a_0 and b_0 by 1.0%, compared to standard (synthetic) cassiterite.

Keywords: XRD study, cassiterite, Bastar district, Madhya Pradesh.

Tin-bearing rare-metal pegmatites in the Bastar-Koraput pegmatite belt (Lamba, 1980; Lamba and Agarkar, 1988; Ramesh Babu,1993) predominently occupy the weak zones in the metabasic rocks, and are typically exposed at Govindpal (18° 42' N. Lat. : 81° 54' E. Long.), Mundval (18° 39' : 81 56'), Chitalnar (18° 40' N. Lat. : 81° 55' E. Long), and Chiurwada (18° 44' : 81° 53') villages in SE-part of the tin-ore belt in Bastar district, M.P. The important rock-forming and ore minerals in these pegmatites are cleavalandite, K-feldspar, quartz, muscovite, Li-micas, beryl, fluorite, tourmaline, cassiterite and columbite-tantalite. Results of X-ray diffraction (XRD) on cassiterite are presented and compared with standard one in this note.

Mode of occurrence : Cassiterite occurs in pegmatites as discrete dipyramidal crystals, disseminated fines in albitised and greissenised zones and occasionally as solid veinlets in quartz core as seen in Govindpal village. The crystals (upto 5 cm) are mostly dark grey in colour with a sub-metallic lusture and give a greish streak, whereas cassiterrite in the placers gives a brownish streak.

Results and Discussion : The cassiterite crystals collected from the pegmatite of Govindpal (Sample 'A') and the cassiterite placer concentrate from Mundval (Sample 'C') and Chiurwada (Sample 'E') were subjected to XRD study using a Philips P.W. 1129 X-ray diffractometer, with the following operating conditions :- power setting of 30 KV and 30 MA, Fe Kα (= 1.937 Å), Mn filter, scanning speed 0.05 ° per minute, time constant 2 mm per sec. and slit 0.3 mm.

XRD data on the study samples, when compared with standard cassiterite (synthetic) and columbite-tantalite (A.S.T.M. card nos. 21-1250 and 16-337) (Tables I and II) reveal the following:

(i) the data on different interplaner spacings and unit-cell dimensions of study cassiterite compare closely with that of standard;

(ii) the presence of additional peaks with 'd' of 6.2568 Å to 3.4695 Å points to a sub (outer) shell in addition to a super (inner) shell with peaks from 'd' of 3.2827 Å to 1.3225 Å, which correspond, respectively, to columbite-tantalite and cassiterite. This feature may be due to substitution of Sn^{+4} (0.71 Å) by both Nb^{+4} (0.77 Å) and Ta^{+5} (0.68 Å) because of similar ionic sizes and

(iii) the solubility of Nb and Ta in cassiterite samples of Bastar district, M.P. has led to decrease in average axial length of a_0 and b_0 by 1.0% (cf. Weibel, 1956).

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Table I. XRD data of Cassiterite from Bastar district, India compared with standard (synthetic) Cassiterite.

Standard (Synthetic) Cassiterite, A.S.T.M. Card No. (21-1250)			Cassiterite of Bastar District (Inner shell)						
			Sample 'C'		Sample 'A'		Sample 'E'		
d(Å)	I/I_1	hkl	d(Å)	I/I_1	d(Å)	I/I1	d(Å)	I/I1	hkl
3.351	100	110	3.282	70	3.329	35	3.310	40	110
2.644	80	101	2.658	20	2.641	30	2.623	60	101
2.365	24	200	2.361	30	2.356	20	2.408	25	200
2.309	6	111	2.303	20	2.303	8	2.294	20	111
2.120	2	210	2.031	100	2.035	100	2.092	20	210
1.765	65	211	1.753	60	1.765	25	1.758	100	211
1.675	18	220	1.662	20	1.677	12	1.671	50	220
1.593	8	002	1.604	10	1.595	12	1.593	20	002
1.498	14	310	1.490	20	1.498	16	1.493	30	310
1.439	18	112	1.435	60	1.441	30	1.435	30	112
1.415	16	301	1.408	20	1.416	20	1.408	30	301
1.322	8	202	1.322	25	1.320	12	1.334	20	202
a_0	(Å)	4.738	4.722		4.713		4.816		
b_0	(Å)	3.335	3.282		3.329		3.310		
c_0	(Å)	2.309	2.303		2.303		2.294		
A		1.421	1.439		1.416		1.455		
C		0.692	0.702		0.692		0.693		

Table II. XRD data of Cassiterite from Bastar district, India, compared with standard Columbite-Tantalite

Standard Columbite-Tantalite, A.S.T.M. Card No. (16-337)			Cassiterite of Bastar District (Outer Shell)					
			Sample 'C'		Sample 'A'		Sample 'E'	
d(Å)	I/I_1	hkl	d(Å)	I/I_1	d(Å)	I/I_1	d(Å)	I/I_1
7.13	12	020	6.256	35	6.327	30		
			5.774	17				
5.30	4	110						
			5.237	100	5.213	100		
			4.733	18	4.814	10		
3.57	10	040						
			3.490	100	3.480	35		
2.96	100	131					2.943	24
2.86	10	200	2.615	50				
2.04	4	241			2.009	8		

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