TABLE I

Detailed location and specific gravity of the ilmenites analysed

Sl. No.	Sample number	General location	Sheet number	Grid location	Specific gravity
1	SR-BM_4/61	Near the mouth of river Vamsadhara, ½ mile E of Revu Ampalam	74 B/3	RE 781283	4·69
2	G-175/60	Near the mouth of river Nagavali ¼ mile E of Khazipeta	65 N/16	E 575117	4·73
3	G- A/63	Near Waltair, ¼ mile E of East Point Rest House	65 O/6	RJ 872490	4·76

TABLE II

Comparative study of east coast ilmenites with ilmenites elsewhere

Sl. No.	Location	% TiO_2	% FeO	% Fe_2O_3	% Fe_2O_3/FeO	SiO_2
1	Vamsadhara mouth ..	..	35·99	..	..	..
		52·23, 51·98	37·06, 36·36	8·56, 9·72	9·23, 0·27	0·6, 0·5
2	Nagavali mouth ..	51·38, 52·28	39·39, 38·81	8·92 9·27	0·23, 0·24	0·6, 0·4
3	Waltair ..	48·11. 47·81	31·11, 31·41	20·92, 19·87	0·67, 0·63	0·4, 0·6
4	Chavara, Travancore ..	60·8	10·43	24·30	2·33	0·8,
5	Manavalakurichi, Travancore ..	53·60, 54·30	26·70, 26·00	14·20, 15·50	0.53, 0·6	1·5, 1·4
6	Brazil ..	48·3	32·4	16·6	0·51	1·4
7	Malayan tin-placer residues ..	53·4	32·6	8·2	0·25	..
8	Albemarle Sound, North Carolina, U.S.A.	50·5	34·9	10·4	0·3	..

(1 to 3—Author; 4—Rao *et al.*[3]; 5 and 6—Barksdale[4]; and 7 and 8—Gillson[5])

are suitable for ferro-carbon-titanium and other ferro-alloys manufacture, the feasibility of the production of these and other alloys of titanium on an industrial scale can only be worked out after a detailed techno-economic survey of the project.

The financial assistance of the Department of Atomic Energy during the progress of this work is thankfully acknowledged.

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ON THE DISCOVERY OF GRAYWACKES IN THE PRE-CAMBRIANS OF RAJASTHAN FROM NEAR UDAIPUR CITY

NONE of the earlier workers reported true graywackes from the Pre-cambrians of Rajasthan. Heron[1] has, however, referred casually to (*i*) the resemblance of the quartzites (or merely their roughness) of the area west of Delwara (24° 47′ : 73° 45′) and N.E. of Rama (24° 44′ : 73° 41′) with the graywackes and (*ii*) "a grade of sediment describable as schistose graywacke" in the triangular area on the south of Banas river. The present author came across graywackes for the first time during the course of his geological mapping around Udaipur between the years 1958-64, and the note gives a preliminary account of these rocks.

Graywackes have been defined differently and their formation ascribed to different environments by various authors.[2] The rocks under study, however, fulfil the characteristics of graywackes stated by Pettijohn[3] and Carozzi.[4]

The graywackes are encountered within the Aravallis around the city of Udaipur, *e.g.*, south of Udaipur Railway Station and near the village of Balicha (24° 31′ : 73° 40′) (Fig. 1). They occur as hard and resistive bands amidst the shales, phyllites and sericite schists of Aravallis. They trend roughly N-S parallel to the foliation strike of the associated rocks. They dip usually at high angles and are even vertical at several places. The thickness is variable; ranging between a few inches to tens of feet and even more.

The rocks are dominantly black in colour, massive, compact, very hard, highly jointed and break with a sub-conchoidal fracture. Graded bedding and slump structures are common but cross-bedding is absent. Detrital quartz and feldspar grains are evident to the unaided eye.

Veins of quartz and calcite are found invading the graywackes.

FIG 1.

GEOLOGICAL SKETCH CUM LOCATION.

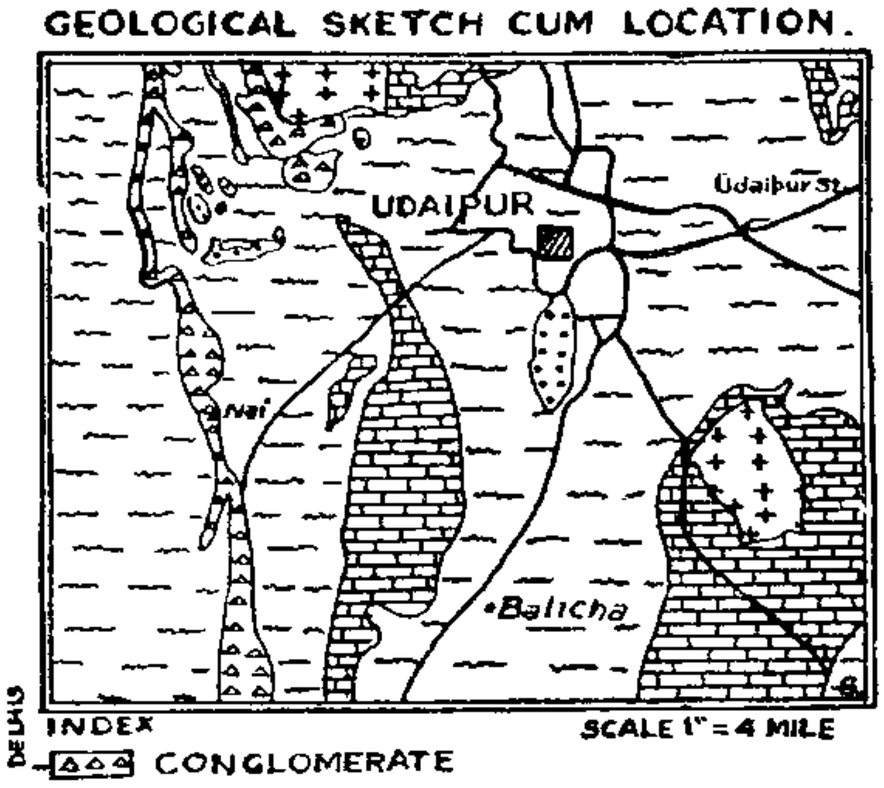

FIG. 2

Several varieties, named below, have been recognized under the microscope. Among them the feldspathic type is most dominant.

(*a*) Feldspathic graywackes (coarse and medium-grained);

(*b*) Lithic graywackes (coarse and medium grained);

(*c*) Fine-grained graywackes with no metacrysts.

(*d*) Quartz graywackes (medium and fine grained);

(*e*) Graywackes with calcite megacrysts.

The most important textural feature is the penetration of matrix minerals like biotite and chlorite flakes in the body of quartz megacrysts, thereby giving rise to comb-like appearance or "chevaux-de-frise" of Greenly. These rocks are poorly sorted and contain fragments of sedimentary and metamorphic rocks.

The matrix consists of micro-crystalline aggregate of quartz, folia and flakes of biotite, chlorite and sericite, feldspar, actinolite and iron ore. Tourmaline, calcite and epidote occur as subordinate constituents. The megacrysts are angular to sub-angular grains of plagioclase (oligoclase to labradorite) (Fig. 2), quartz, calcite and rarely of the fragments of shale, phyllite and quartzite. Microcline is absent whereas orthoclase is present occasionally. The tabular and angular plagioclase metacrysts look mostly clear and fresh but slight cloudiness may be seen.

The poor sorting, poor rounding and the presence of detrital matrix instead of chemical cement suggest short transport. The presence of mixed fine and coarse-grained detritus, graded bedding and marked variation in the thickness of interbedded phyllites indicate the introduction of sediments by turbidity currents of varying intensity. The high feldspar content suggests deposition in narrow and rapidly subsiding geosynclines.[5]

The author's thanks are due to Prof. K. P. Rode for his invaluable discussions and kindly affording the necessary facilities, to Dr. S. K. Agrawal for his help and encouragement and to Shri B. L. Sharma for taking the photomicrographs.

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