

LETTERS TO THE EDITOR

A PRELIMINARY NOTE ON CARBONATITE IN WAH SUNG VALLEY OF JAINTIA HILLS DISTRICT, MEGHALAYA

Introduction

A PYROCHLORE-BEARING carbonatite was recently discovered in the Wah Sung Valley of Jaintia Hills District, Meghalaya, during exploration by the Atomic Minerals Division of Department of Atomic Energy and detailed investigations are currently under way for evaluation of its rare-metal potential. This carbonatite complex has a large cover of weathered soil rich in pyrochlore and is apt to be a source for production of niobium similar to some of the carbonatites of Africa.

Location

The carbonatite occurs in an area of bowl-shaped setting, ranging in elevation from 880 m to 1500 m m.s.l. (Lat.: 25° 32' 15"-25° 36' 45"; Long.: 92° 06' 30"-92° 08' 30"; toposheet No. 83 C/NW) in the Wah Sung Valley of Meghalaya. It is about 25 km east of Shillong and is approachable from 45 km post on the Shillong-Jowai road (NH-44).

Geologic Setting

The rocks of the area are pre-cambrian gneisses and meta-sediments of Shillong group, represented by quartzite, phyllite and quartz-sericite schist. A small outlier of Cherra sandstone of tertiary age lies in the south-eastern parts of the area. The pre-cambrians occupy higher elevations whereas the central depression of the valley is mainly underlain by an ultramafic igneous complex composed of dunite, mica-peridotite, pyroxenite, nepheline, syenite, ijolite and gabbro. Biotite pegmatites are occasionally noted. The area is largely under a thick mantle of soil and alluvium and is densely wooded.

Carbonatite

Although major portion of the carbonatite is covered by brown coloured soil rich in pyrochlore, some hill slopes after excavation showed that the carbonatite occurs as small irregular injections in the ultramafic complex and as dykes close to its periphery. They are 60-110 m long, 10-30 m wide and display sharp contacts with the host-rock. They show varying trends, the dominant ones being in E-W, NW-SE and NNE-SSW directions, although parallelism among a few dykes is also conspicuous. In general the carbonatite appears to be a ring complex surrounding the central ultramafics.

They are usually medium to coarse grained leucocratic rocks composed essentially of calcite with inter-

spersed fluorapatite, serpentinised olivine and accessory fluorite, pyrochlore, perovskite, magnetite and melanite. Chalcopyrite, pyrrhotite, pyrite, ilmenite, strontionite and phlogopite are some of the other minerals noticed in the carbonatite.

These carbonatites are broadly of two categories—the more homogeneous but less radioactive type, weathering to pale earthy colour and the more heterogeneous and radioactive variety, weathering often to chocolate brown material. Some of the carbonatite bodies exhibit structures of flow banding.

Rare Metals

Preliminary analysis of rock and soil samples from the carbonatite complex has indicated the presence of Nb, Ta, U, Ce and phosphate content in significant concentrations.

High radioactivity, mainly due to pyrochlore, is found to be usually associated with a 15-50 cm wide marginal zone of carbonatite along carbonatite-host-rock boundary. Pyrochlore occurs as cubes and octahedras in shades of yellowish brown to reddish brown colour. Partial chemical analysis* of a sample of pyrochlore, separated from soil from Loyem nulla, is given below:

Per cent					
U ₃ O ₈	ThO ₂	Nb ₂ O ₅	Ta ₂ O ₅	TiO ₂	C ₂ O
2.2	8.5	48.6	2.5	0.3	14.0

The dark chocolate-brown coloured soils, capping the carbonatite, are also highly radioactive and consist mainly of magnetite, fluorapatite (50-60% by weight) and clayey matter along with pyrochlore, perovskite, zircon, garnet, pyroboles and altered iron-oxide minerals. Fluorapatite is identified by X-ray diffraction. Preliminary analyses of a few rock and soil samples from the carbonatite are tabulated below. These indicate high contents of Nb, Sr, Ce and Y but very low Rb in all the samples. Further, some of the

* Nb and Ti are separated from Ta by solvent extraction using T.B.P. After purification of the isolated fractions and estimation of Ti by absorption spectrophotometry, the values of Nb, Ta and Ti are obtained. The coefficient of variance is 5% for Nb₂O₅ and 2% for Ta₂O₅.

samples show higher uranium content with little or negligible thorium.

*	LE-854 soil	GB-35 soil	GB-37 soil Tereya- tlaim	GB-38 soil Shang- pet	LE-581 and LE-582 Mica peridotite with carbon- atite Umteham
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X-ray fluorescence (ppm except where indicated in %)

Nb	2.44%	3.43%	411	187	318	474
Ta	393	476	300†	300†	300†	300†
Y	83	84	236	118	33	24
Sr	1755	1581	1612	1265	3368	1799
Ba	415	538	440	519	707	956
Ce	012	1440	2629	1372	207	175
Rb	15	10†	10†	22	28	53
Zn	431	..	..	..	253	183

*	LE-584 soil Layem	GB-35 soil Layem	GB-37 soil Tereya- tlaim	GB-38 soil Shang- pet	LE-581 and LE-582 Mica perido- tite with carbonatite Umteham
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Spectrographic (ppm)

Ni	36	8	26
Cr	14	14	17
CO	42	11	16
V	194	49	21
Cu	85	12	58
Mn	1.25%	3216	2469
Ti	1288	..	..	..	1188	832

Chemical (present)

P ₂ O ₅	..	27.12	25.10	22.20
SO ₄ ²⁻	..	0.1†	0.1†	0.1†

Rare earth oxides (Total ignited) 1.0† 1.0† 1.0†

U ₂ O ₈	..	0.06	0.008	0.004
TiO ₂	..	..	0.8	0.07

Radiometric (per cent)

eU ₂ O ₈	0.10	..	..	..	0.016	0.022
U ₂ O ₈	0.065	..	..	..	0.015	0.018
ThO ₂	0.12	..	..	..	0.009	0.013

.. not determined. * analysed by AMD Labs.,
Hyderabad. † less than.

Discussion

The Wah Sung valley carbonatite appears to be of a "closed type" as per classification of Smirnov¹ and may hence be expected to extend considerably downwards widening at depth. Preliminary geological fieldwork has established that the ultra-mafic rocks occurring as a plug are surrounded by the ring complex of the carbonatite bordered by the alkalic rocks which could be products of fenitization due to metasomatism of the granite gneisses, the hosts in which the complex is intrusive. Further work is in progress. Mineralogically, it seems to belong to the rare-metal rare-earth category, akin to the Barreiro deposits of Brazil (Smirnov¹). The discovery of this carbonatite is, therefore, not only of geological interest on account of its geographic location in the north-eastern end of the Indian Shield, but also significant as possible large source of pyrochlore and other rare-earth minerals for niobium requirements in the future.

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Atomic Minerals Division,
Department of Atomic Energy,
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1. Smirnov, V. I., *Geology of Mineral Deposits*, Mir Publishers, Moscow, 1976, p. 138.

THE EVALUATION OF POLAR AND STERIC EFFECTS ON THE RATES OF METHOXIDE ION CATALYSED CONDENSATION OF SOME *o*-SUBSTITUTED BENZALDEHYDES WITH 3, 5-DIMETHYL-4-NITROISOXAZOLE IN METHANOL MEDIUM

IN continuation of our earlier work^{1,2} on the base catalysed condensation of different mono and disubstituted benzaldehydes with 3,5-dimethyl-4-nitroisoxazole, the steric effects on the above reaction were studied by varying the substituents (*viz.*, NO₂, Br, Cl, CH₃ and O-CH₃) in the ortho position of benzaldehyde. The reaction was followed spectrophotometrically at $\lambda = 400$ nm at which the 5-styryl derivative (end product of this reaction) obeys Beer's Law. The bimolecular rate constants (k''), polar (P) and steric (S) parameters for all the reactions studied are presented and discussed. Applicability of Taft's equation ($\log k/k_0'' = \sigma^* \rho^* + \delta E_s$) for ortho substituents and quantitative separation of polar and steric effects of these substituents are some of the new features not reported earlier.