

South Indian region marking the base of the Paleocene.

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A NOTE ON THE LATE MIDDLE EOCENE NANNOFOSSILS FROM LAKHPAT, KUTCH

THE samples (L1 and L2) were collected from the cream coloured fossiliferous argillaceous limestone exposed in southeastern part of the Lakhpatt fort (23° 49' 30" N: 68° 27' 0" E) for studying their calcareous nannofossils. These samples have not only yielded a rich assemblage of nannofossils but also a rich assemblage of foraminiferids. The foraminiferids include *Nummulites exponens* (Sowerby), *Discocyclina dispansa* (Sowerby), *D. sowerbyi* Nuttal, *Globigerina frontosa* Subbotina, *G. ouachitaensis* Howe and Wallace, *G. yeguaensis* Weinzierl and Applin, *G. praebulloides oclusa* Blow and Banner, *Globigerinapsis kugleri* Bolli, Loeblich and Tappan, *Globigerinatheca barri* Bronnimann, *Orbulinoides beckmanni* (Saito), *Globorotalia centralis* Cushman and Bermudez, *Truncorotaloides collectea* (Finlay), *T. rohri* Bronnimann and Bermudez, *T. topilensis* Cushman and *Pseudohastigerina micra* (Cole). The foraminiferal assemblage of these samples (L1 and L2) are referred to *Nummulites exponens* biofacies (Sen Gupta<sup>1</sup>) and to *Orbulinoides beckmanni* Zone (Samanta<sup>2</sup>). Sen Gupta<sup>1,3</sup> and Samanta<sup>2</sup> have recorded the geological set up at Lakhpatt (Table I).

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TABLE I

Age	Lithological Units	Large Foraminiferal Zones (Sen Gupta <sup>1</sup> )	Planktonic Foraminiferal Zones (Samanta <sup>2</sup> )	Nannoplankton Zone (Present work)	Thickness in meters
Oligocene	Foraminiferal limestone	4			9
	Light coloured fossiliferous limestone; argillaceous at places with abundant foraminiferids and few mollusks	3	<i>Truncorotaloides rohri</i> Zone		4.6
		2	<i>Assilina exponens</i> biofacies <i>Discocyclina</i> biofacies	<i>Disocoaster-tani nodifer</i> Zone	45
Middle Eocene	Highly Laterized foraminiferal limestone and limonite-rich clay containing minor bands of gypsum with two species of <i>Nummulites</i> only		<i>Orbulinoides beckmanni</i> Zone		5
? Cretaceous-Eocene	Laterites and Deccan Traps				

The samples (L1 and L2) have yielded a rich assemblage of calcareous nannofossils consisting of *Braarudosphaera africana* Stradner, *B. bigelowi* (Gran and Braarud), *B. discula* Bramlette and Riedel, *B. Lakshpatensis* n. sp., *Chiasmolithus gigas* Bramlette and Sullivan, *Coccolithus pelagicus* (Wallich), *Cyclcoccolithina formosa* (Kamptner), *Discoaster* sp., *D. barbadiensis* Tan Sin Hok, *D. saipanensis* Bramlette and Riedel, *D. lodoensis* Bramlette and Riedel, *D. sublodoensis* Bramlette and Sullivan, *D. tani* Bramlette and Riedel, *D. tani nodifer* Bramlette and Riedel, *D. trinus* Stradner, *Lophodolithus reniformis* Bramlette and Sullivan, *Reticulofenestra bisecta* (Hay, Mohler and Wade), *R. umbilica* (Levin) Martini and Ritzkowski, *Thoracosphaera* sp., *T. deflandrei* Kamptner and *Triquetrorhabdulus inversus*. Bukry and Bramlette. The present nannoplankton assemblage has been referred to an informal *Discoaster tani nodifer* zone which is correlatable with the upper part of Martini's NP 16, *Discoaster tani nodifer* Zone (late Middle Eocene; Martini<sup>2</sup>).

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#### RAPID ATOMIC ABSORPTION SPECTROPHOTOMETRIC METHOD FOR ESTIMATION OF (REACTIVE & TOTAL) SILICA, IRON, ALUMINIUM AND TITANIUM IN BAUXITE

DISCOVERY of huge bauxite reserves in the East Coast of India and the exploration programme taken up by the Geological Survey of India during the field season 1975-76 aimed at assessing the extent and grade of bauxite has necessitated the analysis of large number of samples in different laboratories of Geological Survey of India. Conventional methods of bauxite analysis are very slow and naturally cannot keep pace with the progress of the drilling programme envisaged in this time bound project. It has therefore

become necessary to devise rapid methods of analysis involving the use of instrumental methods.

Though Atomic Absorption Spectrophotometry (AAS), X-ray-Fluorescence (XRF) and Neutron-Activation techniques are ideally suited to provide the desired rapidity coupled with high precision and accuracy, it is only with regard to the AAS technique that facilities can easily be created at a reasonable cost, while the other two require a more expensive and sophisticated set up. Bowman and Willis,<sup>1</sup> who had earlier attempted bauxite analysis by the AAS technique, preferred sodium-carbonate-borax fusion in a platinum crucible to either triacid treatment ( $H_2SO_4 + HNO_3 + HClO_4$ ) or alkali fusion in a nickel crucible for decomposition of bauxite. Langmyhr and Paus<sup>2</sup> resorted to HF treatment of siliceous material in a teflon bomb prior to AAS analysis of Si, Al, Fe & Ti. Such methods of decomposition involving the use of platinum ware, etc., cannot answer the need of routine analysis on a large scale.

Detailed studies carried out by the authors have resulted in a rapid method, involving fusion of bauxite with potassium pyrosulphate in a hard glass pyrex test-tube and dissolution of the fused mass in 2N HCl before subjecting to AAS analysis. This method proved to be so fast that a team of five analysts could process at the rate of 1000 samples a month. Nearly 7500 samples from the East Coast Bauxite project were analysed by this method during the period August 1976 to April 1977.

A distinct advantage of this method lies in the determination of reactive silica along with the other four constituents. Silica brought into solution by pyrosulphate fusion corresponds to the reactive component of the total silica which according to Schellman<sup>3</sup> is mostly contributed by the clay minerals present in bauxite. Information about its actual content in bauxite is a vital necessity as it has a significant bearing in Bayer's extraction process. While conventional methods<sup>4</sup> reported in literature are cumbersome, our method provides a neat and rapid means of estimating the same. Three samples from Dr. Schellman, BGR, Hanover analysed for reactive silica by the AAS method gave values which compare very well with conventional analysis. (Probe No. 1166, AAS 2.36%, Conv.—2.42%. Probe No. 1111, AAS—0.84%, Conv.—1.00%; Probe No. 619, AAS—5.62%, Conv.—5.42%).

As silica present in the form of quartz and sillimanite cannot get extracted by pyrosulphate fusion, separate alkali fusion in a nickel crucible was suggested for the estimation of total silica in bauxite.

A check analysis for total  $SiO_2$ ,  $Fe_2O_3$ ,  $Al_2O_3$  and  $TiO_2$  in respect of three samples by the conventional