TABLE II

Determination of vanadium in vanadium steels

Sample	Vanadium content of solution, ppm	
	Certified value	Found
1. No. 4. CrlMo95–V85TIB	0·9625	0·9648
	1·9250	1·9120
	3·850	3·8450
2. H No. 7, 2034, 15CDY6	0·7656	0·7580
	1·860	1·865
	2·714	2·695
3. $T_{100}V_{25}$	1·006	1·000
	2·012	2·018
	3·024	3·000

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SYNDIAGENETIC MICROSTRUCTURES DUE TO INTERNAL FILLING IN TERMITE MOUNDS

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ABSTRACT

Pedographic study of the thin sections of the termite mounds, occurring on different geologic formations, revealed certain microstructures consisting of 'birdseye', cyclic depositional zones, Leisegang structures, and rim cement resulting from the internal fillings of the soil framework during the syndiagenesis of the termite mound. All these microstructures are similar to those developed during the diagenesis of carbonate sediments.

TERMITES construct their mounds on the ground surface with a widely varied size, shape, and architectural style. For the construction of these mounds, the termites carry in their mandibles the soil particles which are placed in position and are cemented with a mortar consisting of their saliva or excrement mixed with clay. This mechanical process of construction has been observed directly by several workers (Beaumont[3,4] Hill[8], Emerson[6] Grasse, Stuart[16] and others). Thus lithification of the mound is initially carried out by the termites. The physical and chemical changes, involved in the formation of termite soils, have been discussed by Lee and Wood[11].

The important constituents in the termite soils are various types of clay mineral and iron oxides which are mainly formed by chemical weathering of the silicate minerals. The organo-mineral colloids which are a mixture of floccules and gels (Tyulin[18]) are commonly developed by the clay and iron compounds together with organic matter. Iron in the presence of organic matter is mobilised (Jackson[10], p. 128). Hence the organo-mineral colloids are mobilised and reconstituted leading to the diagenesis of the termite mounds.

In order to investigate the processes of diagenesis involved in the development of termite mounds, samples of the mounds, developed on the soils derived from different geological formations, were collected. Thin sections of these samples, for microscopic study, were prepared after impregnating them with xylene and Canada balsam, as suggested by Ireland[9]. Stoops[15] has also carried out the petrographic study of the thin sections of the termite mounds.

The thin section study, in the present work, revealed certain excellent microstructures involving the development of the 'birdseye', cyclic deposition, Leisegang phenomenon, and rim cementation leading to the diagenesis of the termite soils in the formation of the mounds. All these microstructures are open-space

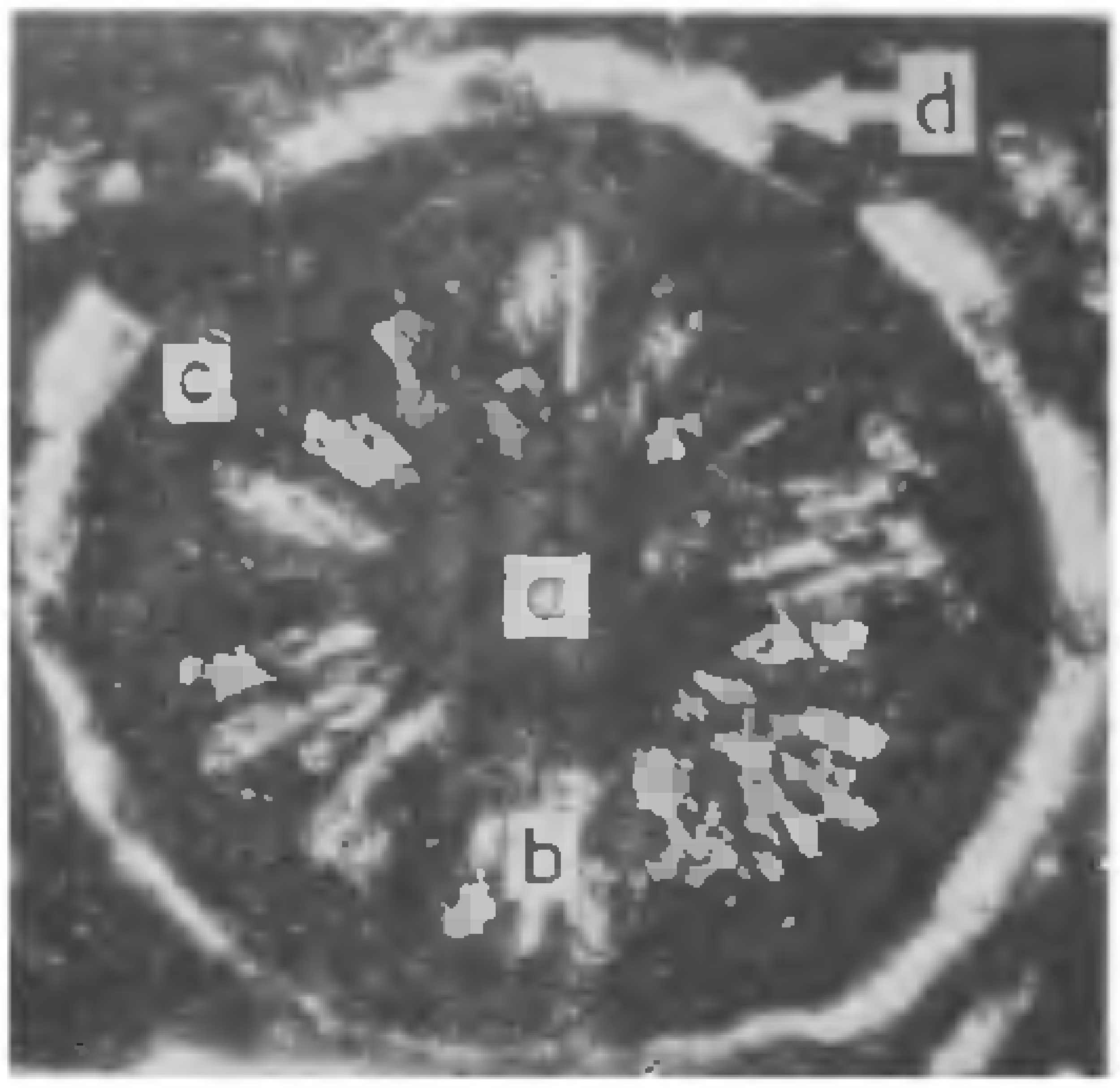

FIG. 1. 'Birdseye', Ordinary light; The successive circular zones and their diameters are as follows:

Zone: (*a*) Opaque central zone, 160 microns, Zone: (*b*) Radial zone; the radial syneresis crack filled by opqque iron oxide, and the alternating bright lines are clay. Zone (*c*) Blood-red rim (titaniferous), 60 microns; Zone: (*d*) Unfilled (or partially-filled) open-space of the cavity; 540 microns.

structures which, according to Wolf[18], are the result of internal filling and sedimentation processes of physico-chemical, biochemical, and physical nature, causing partial to complete filling of voids within sedimentary frameworks.

'Birdseye'

This structure, originally coined for a spot or a tube or spatry calcite in limestone, has been recorded from a termite mound developed on the soil underlain by shale. It consists of a nearly opaque central zone (Fig. 1 *a*), a radial pattern (Fig. 1 *b*), and an outer rim (Fig. 1 *c*) which is blood-red in colour. The entire structure is within an incompletely-filled circular void (Fig. *d*).

In the microenvironment of the termite mound, decomposition of organic matter releases certain gases such as carbon dioxide and ammonia. When these gases escape, cavities are formed in which clay is precipitated as a colloidal gel; its hardening with the expulsion of water produces radial syneresis cracks which are subsequently filled by iron oxide giving rise to the development of the 'birdseye' structure. The origin of 'birdseye' in carbonate rocks has been discussed by Perkins[12] and Wolf[18].

Cyclic Depositional Zones

A thin section of a termite mound, developed on a khondalite soil, has revealed a triangular zoned-structure. It consists of five distinct zones comprising three generations of clay (zones: *a*, *c*, and *d* in Fig. 2) and two generations of iron oxide (zones: *b* and *e*, in Fig. 2). Clay zones *a* and *c* are isotropic while the clay zone: *d* is anisotropic and distinctly fibrous (Fig. 3): it shows preferred orientation of the longer grain axis normal to the surface of the host zone, *viz.*, zone: *c*. Two sides of the triangular zonal structure are in a channel while the base is in contact with the soil plasma (*matrix*).

The structure is the result of cyclic deposition of the fluids saturated with clay and iron oxide. Such structures are also developed by the diagenesis of carbonate sediments (Chilingar *et al*[5]).

Leisegang Structure

Leisegang structure in clay (*a* in Fig. 4), which incompletely fills a cavity (*b* in Fig. 4), was recorded from a termite mound developed in the soil derived from quartzite and granite. This structure consists of alternating layers of light and dark clay.

Leisegang structure is produced by a diffusion phenomenon due to alternation between solution mobility (diffusion) and supersaturation (nucleation and precipitation). It especially occurs in open spaces where oxidation is followed by desiccation.

Leisegang phenomenon has also been observed in syndiagenetic phases of sediments, both marine (Stetson[14]) and fresh water (Sugawara[17]).

Rim Cement

Clay, occurring as a 'rim cement' around a single quartz grain (*a* in Fig. 4) is noticed in a termite mound developed on a sandstone soil. The clay rim (*b* in Fig. 4) is isotropic while the quartz grain shows undulose extinction.

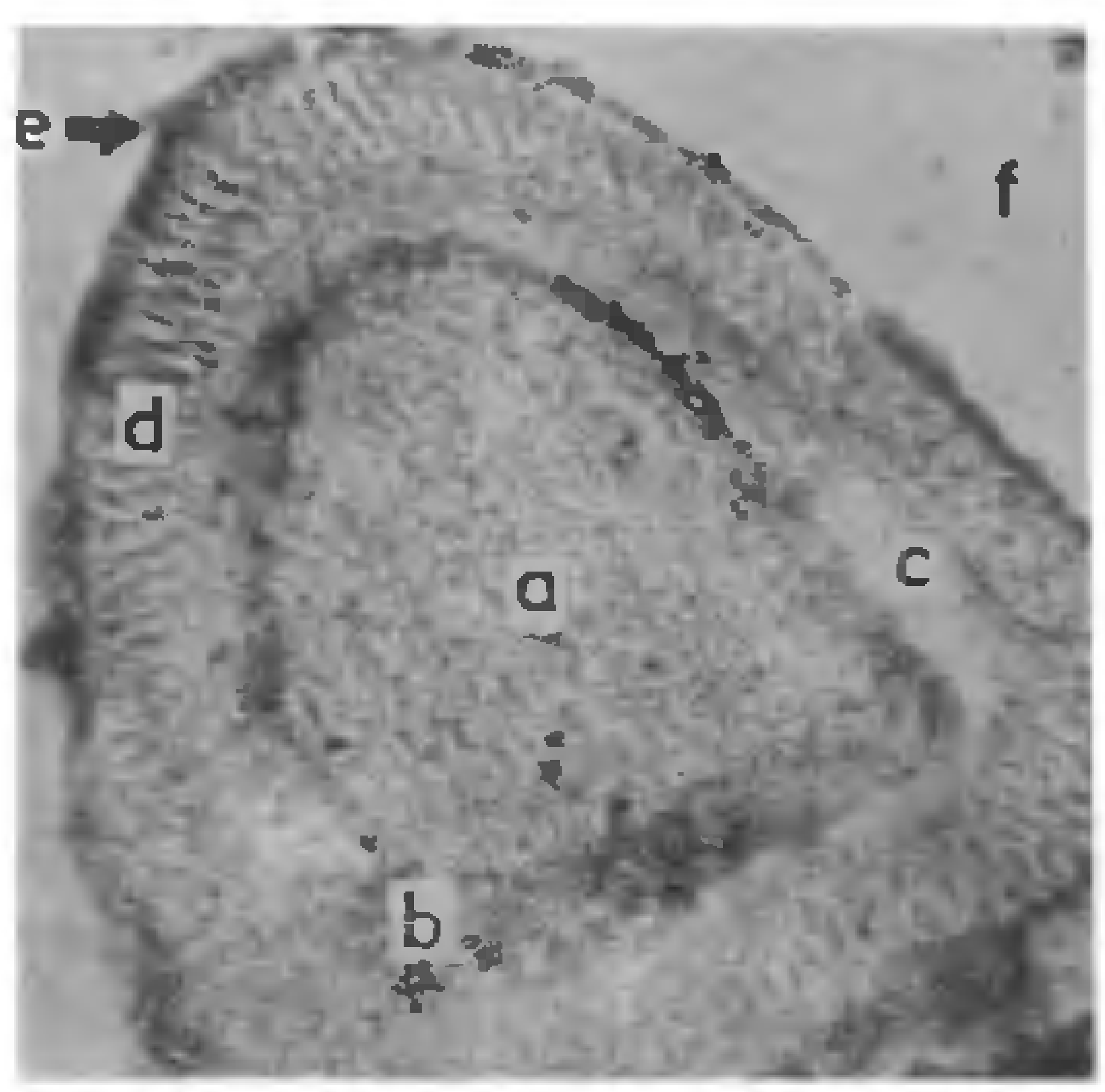

FIG. 2. Cyclic depositional zones; Ordinary light. The distance from the summit to the centre of the base of the successive triangular zones is as follows:

Zone: (*a*) 280 microns; Zone: (*b*) 375 microns; Zone: (*c*) 410 microns; Zone: (*d*) 590 microns; Zone: (*e*) 625 microns; Zone: (*f*) is a channel.

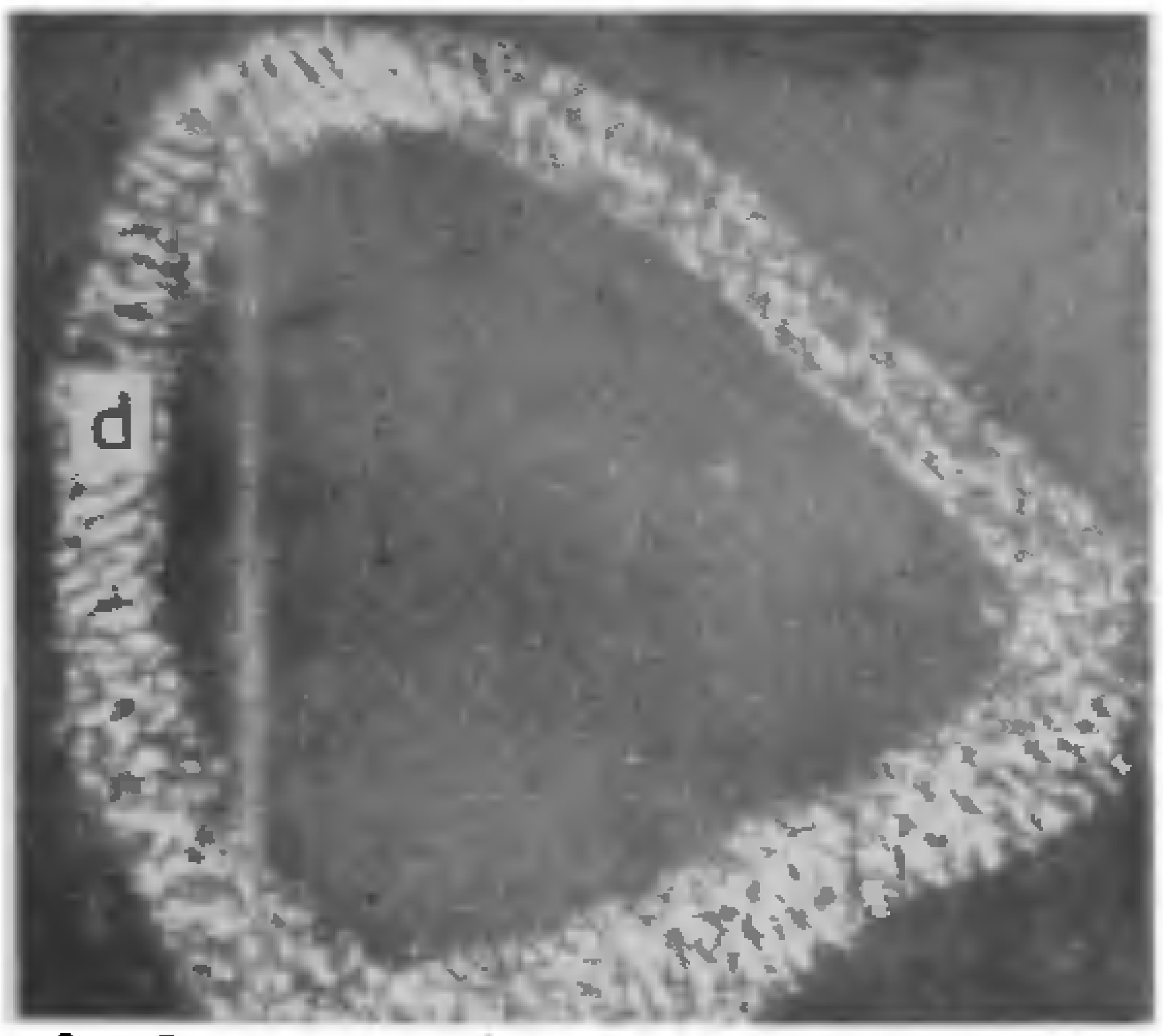

FIG. 3. Same as Fig. 2; under polarised light; zone (*a*) and (*c*) are isotropic, while zones (*b*) and (*e*) are opaque. Conspicuously occurring zone *d* is fibrous clay showing preferred orientation.

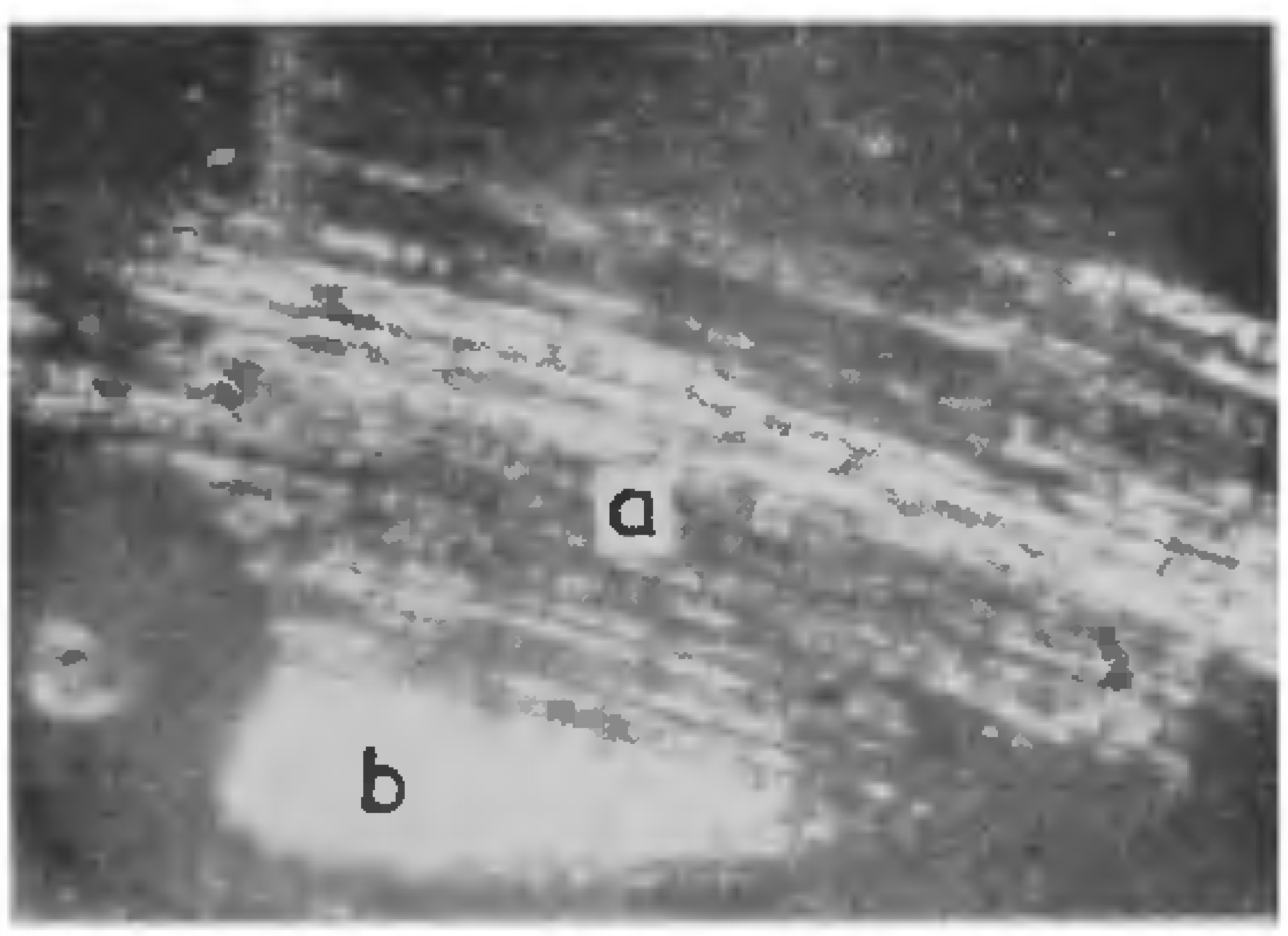

FIG. 4. Leisegang structure shown by the alternate light and dark bands in clay (*a*) length—475 microns, breadth—210 microns; white patch (*b*) is the incompletely filled cavity; Ordinary light.

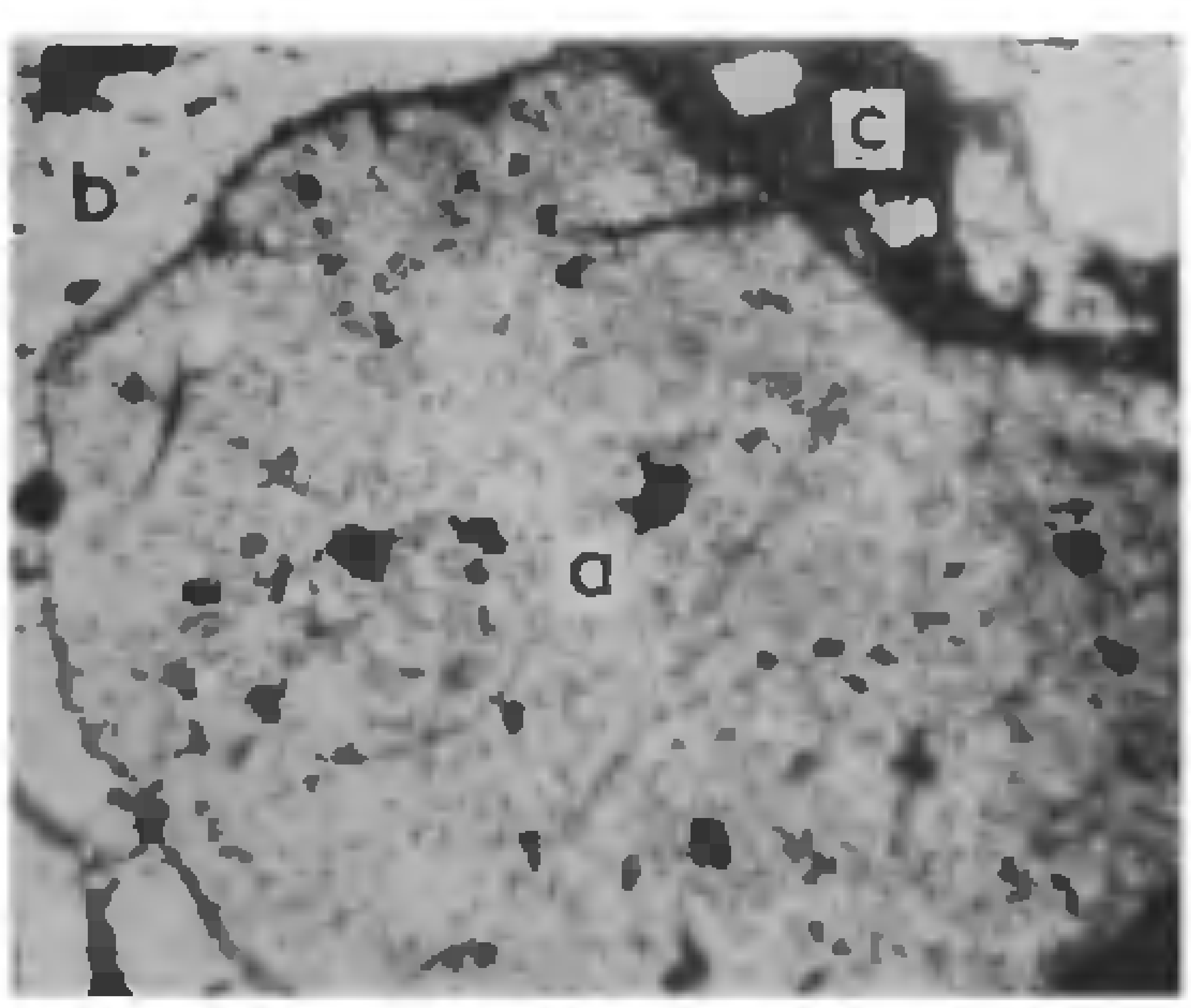

FIG. 5. Quartz grain (long diameter 1380 microns) (*a*) with partially surrounded clay rim (*b*) with width varying from 34-340 microns, the remaining parts of the grain is in contact with iron oxide (*c*) which may be seen to infiltrate and replace the clay rim.

The paragenetic relations, as deduced from the thin section study, reveal that the quartz grain was in contact with surfaces that were once free, *i.e.*, surfaces of voids, which were subsequently filled by clay, giving rise to the rim formation; and this clay rim does not circumscribe the entire boundary of the quartz grain, as it has been, to a large extent, replaced by iron oxide (*c* in Fig. 4).

The rim cement, similar to that seen in the termite mound, is also developed in the diagenesis of carbonate rocks by the same mechanism, *i.e.*, by filling the pore space (Bathurst[1,2], Lucia 1962). But in these rocks both the host and the rim are carbonates and are in lattice continuity with each other; this structure has also been described as "syntaxial rim cementation" in geological literature.

Prasad[13] has discussed, in detail, the hydrogeological significance of the termite mounds. Pedographic study of the thin sections of the termite mounds clearly reveals the diagenetic processes involved in the mound development. Such studies help in understanding the complex diagenetic effects involved in various sedimentary rocks in true perspective. Thus the termite mound serves as an important tool in geology.

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A COMPARISON OF ACID PHOSPHATASE ACTIVITY IN THE SPERMATOGENIC AND ANDROGENIC CELLS OF THE TESTES OF IMPUBERAL AND SEXUALLY COMPETENT *PTEROPUS GIGANTEUS GIGANTEUS* BRÜNNICH (MEGACHIROPTERA: MAMMALIA)

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ABSTRACT

A comparison of the acid phosphatase (AcPase) activity in the spermatogenic and androgenic cells of the impuberal and spermatogenically active testes of *Pteropus giganteus giganteus* displayed characteristic differences. In the impuberal testis, intense AcPase reaction was discerned in the Leydig cells but relatively less enzyme reaction was manifested by cells of the seminiferous epithelium. Spermatogonia, spermatocytes, spermatids, sertoli and Leydig cells of spermatogenically active testis displayed positive but varying AcPase staining. The acrosome of the dimorphic spermatozoa presented positive enzyme reaction. The role of AcPase in relation to growth, cell division and differentiation is discussed. It is suggested that AcPase may be involved in potentiating the male gamete to overcome egg membrane barriers and facilitate at least some of the early steps in the intricate process of fertilisation.

In mammals, spermatogenesis becomes established sometimes after birth. The factors which initiate, sustain and facilitate completion of spermatogenic and androgenic activities in the testes have been well investigated. Metabolic enzymes have been implicated in the growth, cell division and differentiation of testicular cells and their activities[1-4]. However, very little is known about the comparative enzymatic pattern of spermatogenic and androgenic cells of impuberal and sexually competent males[5-6]. The literature provides very little information with respect to Chiroptera[7-9].

The present study was aimed to determine the histochemical site and pattern of distribution of acid phosphatase (AcPase)—a lysosomal 'marker' enzyme in the seminiferous epithelial cells and Leydig cells of the testis of impuberal and sexually competent *Pteropus giganteus giganteus*.

MATERIAL AND METHODS

Males of *P. g. giganteus* were trapped/shot throughout the year from their roosting sites on mango, guava and date palm trees. Animals with undescended (inguinal), small sized and aspermatogenic testis were considered to denote impuberal state. This was confirmed by histological examination. Males with scrotal, deeply pigmented, large-sized and spermatogenically active testes were accepted as mature and sexually competent individuals.

The animals were sacrificed by cervical dislocation. Recovery of tissues and subsequent fixation in chilled neutral formalin (10% at 4° C) was as described earlier[7].

Frozen sections (10 μM) of impuberal and spermatogenically active testis were processed for determining the histochemical site and pattern of distribution in the seminiferous epithelium and Leydig cells, according to Gomori's method as described by Pearse[10]. Suitable controls were run simultaneously.

Enzyme activity in testicular cells was visually appraised and graded as described earlier[7].

RESULTS AND DISCUSSION

In the impuberal testis of *P. g. giganteus* all the seminiferous tubules appeared to be similar. Sper-