قسم التشريح والهستولوجيا
كلية الطب البيطري - جامعة الاسكندرية
رئيس القسم : أ٠د/ أنور قاسم

دراسات باستخدام الميكروسكوب الضوئي والالكتروني الماسح على نمو بصيلة الشعر الوعائي في الجمل وحيد السنام

علي دغباج

قد اتضح من الدراسة أن بصيلة الشعر الوعائي قد بدأت في النمو في الأجنة طول ٧٥ مم على هيئة كومة من خلايا البشرة وقد اتبعت في نموها نفس تسلسل خطوات النمو في الشعر العادي ٠

وقد أوضحت صور الميكروسكوب الالكتروني الماسح بأن خلايا جلد الشعرة تحمل ثنايا وبروزات دقيقة كما أوضح الميكروسكوب الالكتروني الناقل بأن الغشاء الخلوي لهذه الخلايا يكون متحور الى خمس طبقات أو الى ثلاث طبقات متحورة ٠

كذلك أوضحت الدراسة عدم وجود تغييرات جذرية في تركيب الشعرة في الفترة بعد الولادة من العمر ٠

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LIGHT AND SCANNING ELECTRON MICROSCOPIC STUDIES ON THE DEVELOPMENT OF THE SINUS HAIR FOLLICLE IN CAMELS (Camelus dromedarius)

With One Table & 13 Figs.)

By
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SUMMARY

The sinus hair follicle starts its development in the lower lip at 75 mm CVRL as a follicular plug and its development has the same sequence fo events as the ordinary hair.

The SEM pictures showed that the cuticle of the hair carries folds and microprojections on its cells. Openings of membrane-bounded vesicles were also observed. The TEM revealed that the plasma membrane of the cuticle cells are modified either into pentalaminar or modified trilaminar membranes.

INTRODUCTION

Sinus or tactile hair follicles are highly specialized for tactile sense. They are very large follicles characterized by a blood-filled sinus between the inner and the outer layers of the dermal sheath. In horses and ruminants, the blood sinus is traversed by fibroelastic trabeculae throughout its length. In pigs and carnivores, the inner layer of the dermal sheath thickens at the upper portion of the follicle, forming a sinus pad whcih is surrounded by a sinus free of trabeculae (DELLMANN AND BROWN, 1976).

No data could be found on the electrone microscopical structure of the tactile hair follicles of camels.

The purpose of this work was to obtain some information on the light and scanning electron microscopic structure of tactile follicles and hairs during the pre-and postnatal life of the camel.

MATERIAL and METHODS

The materials for this work were collected from the lower lips of 16 camel foetuses, ranging between 60-1060 mm CVRL (Table 1). For studying the postnatal structure, 2 samples were collected from fresh-slaughtered animals 2 and 6 years old. The samples were taken and immediately immersed in the fixative (2% formaldehyde, 1.25% glutaraldehyde in 0.1M sodium cacodylate, PH 7.2) and stored at 4°C for SEM. Samples from the same materials used for SEM, were fixed in 10% formalin for light microscopic examinations.

opening appeared on each bulged area, through which the hair emerged in the foetuses of 350 mm. CVRL (Fig. 5). The hairs decreased gradually in diameter towards their tips. The cuticle of the hair is formed from a single layer of highly flattened keratinized cells, partially overlapping one another. The free surfaces of some cells showed irregularity in the form of ridge-like folds parallel to the long axis of the hair. The free edges of these cells had microprojections (Fig. 6).

In the foetuses of 500 mm. CVRL, the ridges became clear in most of the cells and the microprojections gave the cell free edges a serrated form (Fig. 7). At high magnification, the cells, which had ridges also presented many tiny openings allover their free surfaces (Fig. 8). At this age, the bulged area of the epidermis surrounding the hair canal opening became conical in shape, while the canal opening was usually found at its apex (Fig. 9). These bulges were lost from the epidermis at 1000 mm. CVRL by detachment of the peridermal membrane.

SEM examination of the hair follicles showed that the different developmental stages were readily comparable with histological pictures of the LM (Figs. 10, 11).

Postnatally, SEM observations revealed no significant changes from those described in the full-term foetuses except that the minute opening seen on the free surfaces of the cuticle cells were not visible.

Examination of ultrathin sections of the hair by transmission electron microscopy revealed that the tiny openings which appeared by SEM on the cells of the cuticle were openings of membrane- bounded vesicles in the process of discharge. The external surfaces of these cells exhibited either pentalaminer surface membrane (five-layered) or modified trilaminar membrane. The pentalaminar surface membrane (Fig. 12) consisted of: (1) very thickened inner leaflet of the plasma membrane, (2) lighter middle leaflet, (3) thickened outer leaflet of the plasma membrane, (4) slightly thickened lighter lamina and (5) denese outer lamina. A condensation of the cell cytoplasm under the plasma membrane caused the thickening of the inner leaflet. On the other hand, the modified trilaminar surface membrane (Fig. 13) consisted of a very thickened inner leaflet, lighter middle leaflet and slightly thickened outer leaflet which may be covered with fuzzy materials.

DISCUSSION

The present study indicates that the sinus hair follicles follow the same sequence of events in their development as the ordinary hair follicles of camels (DOUGBAG and BERG, 1983) sheep (HARDY and LYNE, 1956), cattle (LYNE and HEIDEMANN, 1959) and buffaloes (EL-SAKHAWY, 1973). DOUGBAG and BERG (1983), mentioned that the hair follicles of camels initiated their development at 15 cm. CVRL and the keratinized hair emerged from the hair canl at 830 mm. CVRL. Meanwhile the development of the sinus hair follicles started in the foetuses of 75 mm. CVRL and the keratinized hair emerged at 350 mm. CVRL. This early differentiation may suggest that the camel foetus may use such sensory hair during the intrauterine period of life. DOUGBAG and BERG (1983) also mentioned that the hair medulla forms the great bulk of the ordinary hair. Incontrast the present study showed that the hair cortex formed the great bulk of the sinus hair. This may explain the regidity of the sinus hair.

In the present study, the blood sinus in the dermal sheath was traversed by fibroelastic trabeculae throughout its length. This is similar to that described in other ruminants and horses (DELLMANN and BROWN, 1976). The latter authors added that in pigs and carnivores the inner

laver of the dermal sheath thickens at the upper portion of the follicle forming a sinus pad, and this was surrounded by a sinus free of trabeculae. Such sinus pad was not found in the camel.

The SEM examination revealed that the cells of the cuticle of the hair have ridge-like folds on their free surfaces. Microridges (Microplicae) were observed on the free surface of stratified squamous epithelial cells lining the alimentary tract, cornea, conjunctiva (ANDREWS, 1976), lingual papillae (DOUGBAG, 1987 a), and skin (DOUGBAG, 1987 b). These microplicae exhibited a wide variety of patterns and density while in the present study they have a simple pattern of folds parallel to long axis of the hair shaft. ANDREWS (1976) mentioned that these microplicae may provide protection by reducing the surface area of contact and thereby the frictional resistance between opposing surfaces. Also they may serve to retain a layer of cushioning and lubricating fluid (sebum) which protects the cellular surfaces from abrasive abuse and may also facilitate the spread of fluid over the surface of the hair.

In the present study, the microprojections at the cell free edges may serve the same functions as the microplicae. The cuticle of the hair showed tiny openings at its free surface, which TEM they appeared to be openings of membrane- bound granules in the process of being discharged onto the surface. Ultrastructural studies of various keratinized epithelia had revealed the presence of such small vesicles referred as memberane- coating granules (FRITHIOF, et al. 1963; FARBMAN, 1964, 1966; MATOLTSY and PARAKKAL, 1965, 1967). These granules have also received various other names: dense granules (ALBRIGHT and LISTGARTEN, 1962; SELBY, 1957), corpuscula (FREI and SHELDON, 1961), Odland bodies (WILGRAM, et al. 1965; WOLF and HOLUBAR, 1967) small striated granules (SQUIER, 1968), lamellar granules (ODLAND and REED, 1967); keratinosomes (WILGRA, 1965) and small lamellated bodies (FRITHIOF and WERSALL, 1965). MATOLTSY and PARAKKAL (1965, 1967) added that these granules appear in the cytoplasm of the spinous cells, then in the granular cells, they migrate towards that portion of the cell membrane closest to the epithelial surface and are subsequently discharged into the intercellular space. The latter authors and ODLAND and REED (1967) added that after a granular cell discharges its granules into the intercellular space, it differentiates into horny cell. The present study showed that these granules discharge also into the free surface of the cuticular cells during the foetal period. This may be due to less differentitation or keratinization of the cuticular cells.

Many opinions were mentioned about the function of these granules as exfoliation of horny cells (WILGRAM, 1965), reduction of the surface area of the plasma membrane (RUPEC and BRAUN-FALCO, 1965), acting as epidermal lysosomes (WOLF and HOLUBER, 1967), contributing to the amorphous intercellular substance (FARBMAN, 1964, 1966) formation of a coat (MATOLTSY, 1966, FARBMAN, 1966. ODLAND and REED, 1967 and thickening of plasma membrance (MATOLTSY and PARAKKAL, 1965, 1967 and MARTINEZ and PETERS, 1971.

MARTINEZ and PETERS (1971) reported that the contents of these granules had repeating lamellar pattern (dense and light lamellae), and after their discharge, they dissociate into discs. These discs fuse to the outer leaflets of the horny cell resulting in a pentalaminar surface membrane (5 lamellae) or amorphous material resulting in a modified trilaminar surface plasma membrane. The present study showed the same modifications which may give the plasma membrane protection and resistance to keratinolytic agents (LAGERMALM, et al. 1951; MATOLTSY and BALSAMO, 1955; KLIGMAN, 1964 and MATOLTSY and PARAKKAL, 1967).

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LEGEND OF FIGURES

Fig. (1): Section through the lower lip in 75 mm. CVRL foetuses, showing follicular blug (f), Epidermis (e) and dermis (d). (H&E stain, Objec. 10, Ocular 6).

Fig. (2): Section from the foetal age of 270 mm CVRL, showing keratinization of the middle cell layers of the epiderms (k). Bud of sebaceous gland (b) and blood vessel entering the dermal sheath (v) are clearly visible. (H&E, Objec. 10, Ocular 6).

Fig. (3): Section through a sinus hair follicle from foetal age of 500 mm CVRL, showing hair (h), inner root sheath (i), outer root sheath (O), the dermal sheath with its blood sinuses (filled of blood cells) (d), Skeletal muscles (m) (H&E stain, Opjec. 40, Ocular 6).

Fig. (4): Scanning electron micrograph, showing the free surface of the epidermis of the lower lip at 330 mm CVRL. Circumscribed bulged area (c) appears at the site of hair canal's opening.

Fig. (5): Scanning electron micrograph, showing emerged hair shafts (h) at 350 mm CVRL.

Fig. (6): Scanning electron micrograph, showing sinus hair shaft taken from 350 mm CVRL, foetus. The cuticle of the hair has keratinized cells (k) partially overlaping one another. Some cells show irregularity (r). The free edges of these cells may carry microprojections (m).

Fig. (7): Scanning electron micrograph of a sinus hair shaft at 500 mm CVRL. Most of the cuticle cells exhibited ridge like folds (arrow).

Fig. (8): The free cell surface, showing minute openings (arrows). The free edge of this cell carry microprojections (m).

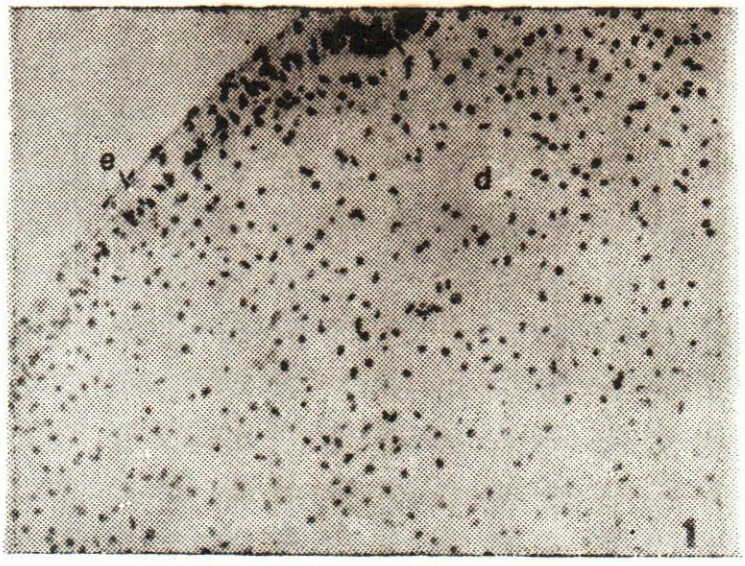
Fig. (9): Scanning electron micrograph, showing the outer surface of lower lip of 500 mm CVRL, foetus. The sinus hairs (h) were surrounded by conical-shaped bulged areas (b) from the epidermis.

Fig. (10): Scanning electron micrograph, showing crossly cut sinus hair follicle of 350 mm CVRL, foetus. The hair (h) has a small medulla. Inner root sheath (i), outer root sheath (O) and dermal sheath (d). Side view of cut epidermis (e) showing, cornified cells at its middle, Hair shaft (s).

Fig. (11): Scanning electron micrograph of crossly cut ninus hair follicle of 500 mm CVRL, foetus, showing hair (h), inner root sheath (i), outer root sheath (o) and dermal sheath with blood sinuses (d).

Fig. (12): Ultrathin section through a cuticular cell, showing modified plasma membrane (pentalaminar). Very thickened inner leaflet (1), lighter middle leaflet (2), thickened outer leaflet of the plasma membrane (3), thick light lamina (4), and thin dense outer lamina (5), cytoplasm (c). X 350,00.

Fig. (13): Ultrathin section through a cuticular cell, showing a modified trilaminar plasma membrane. The inner leaflet is very thickened darkly stained (1), the middle leaflet is lighter (2) and the outer one is slightly thickened darkly stained (3), cytoplasm (c). X 450,000.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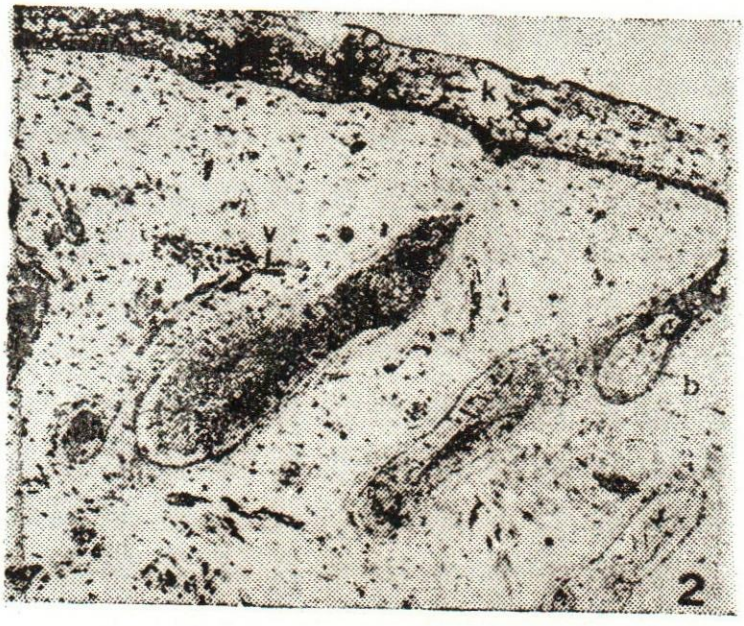
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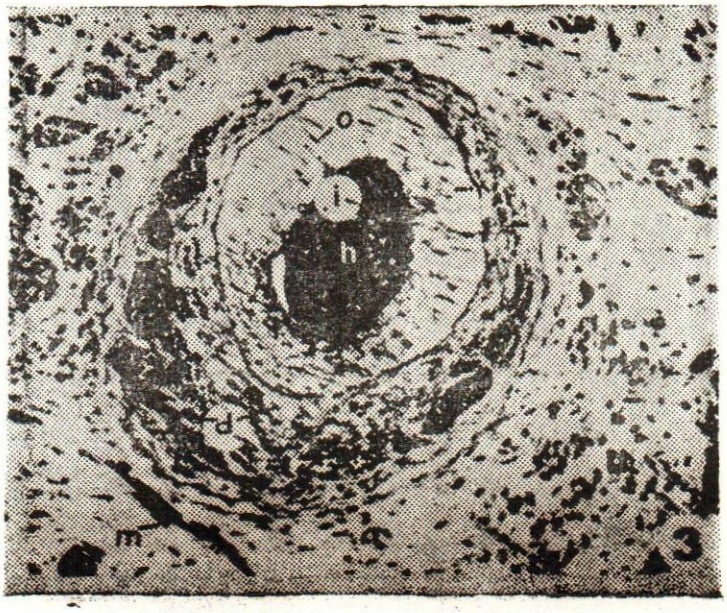
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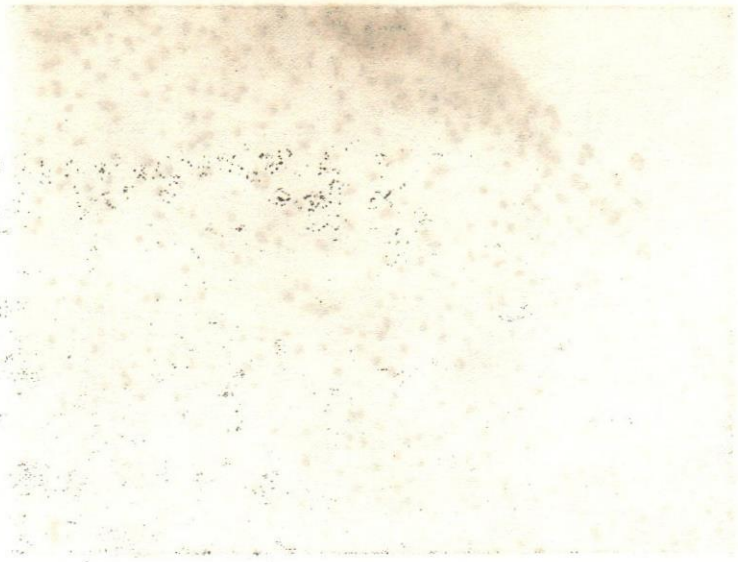

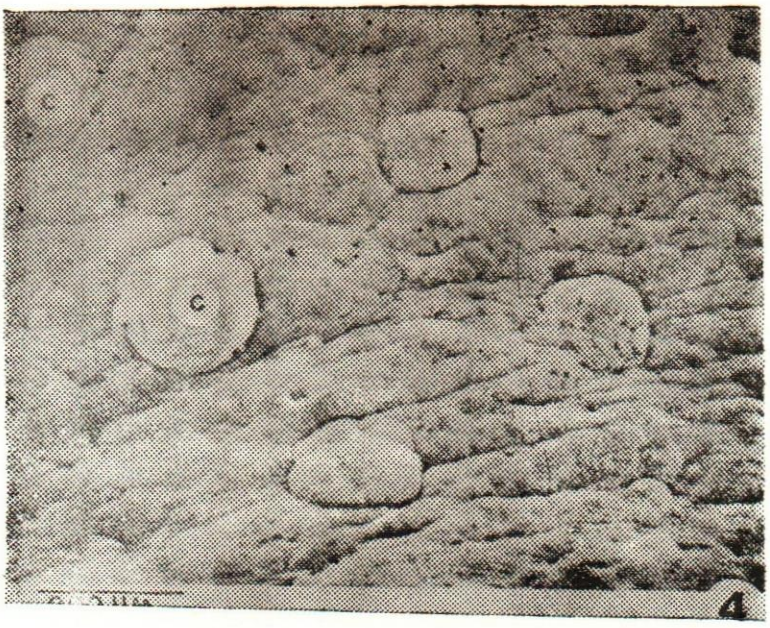
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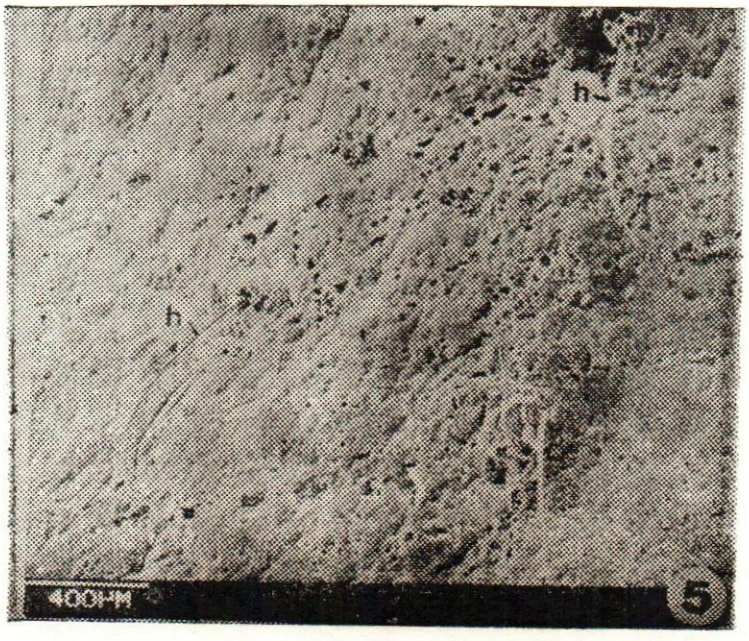
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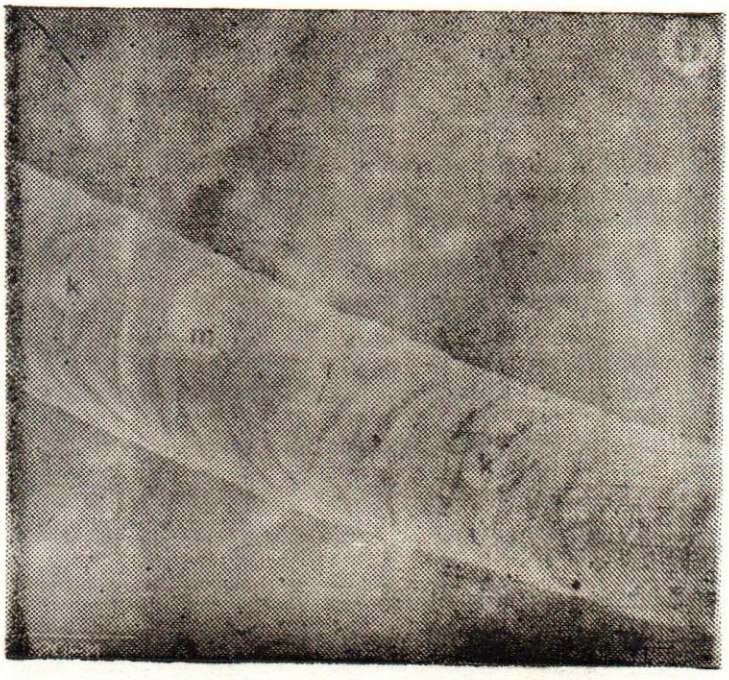
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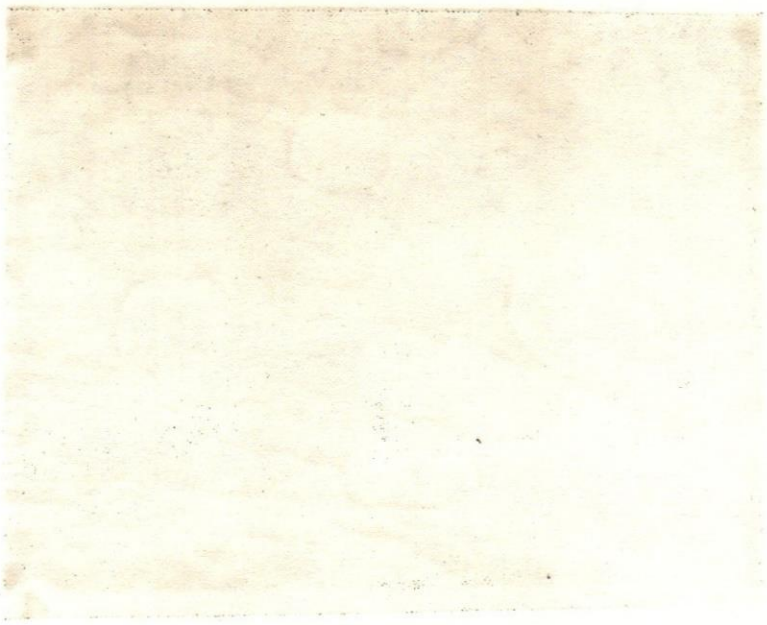

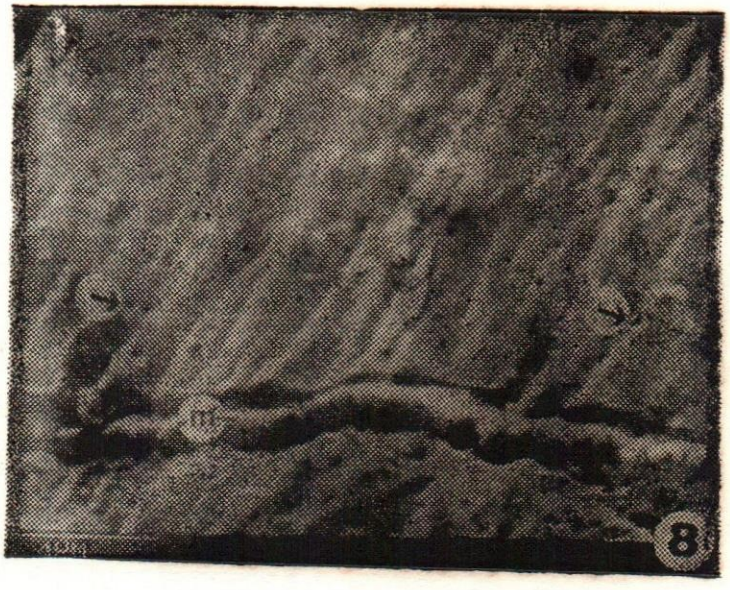

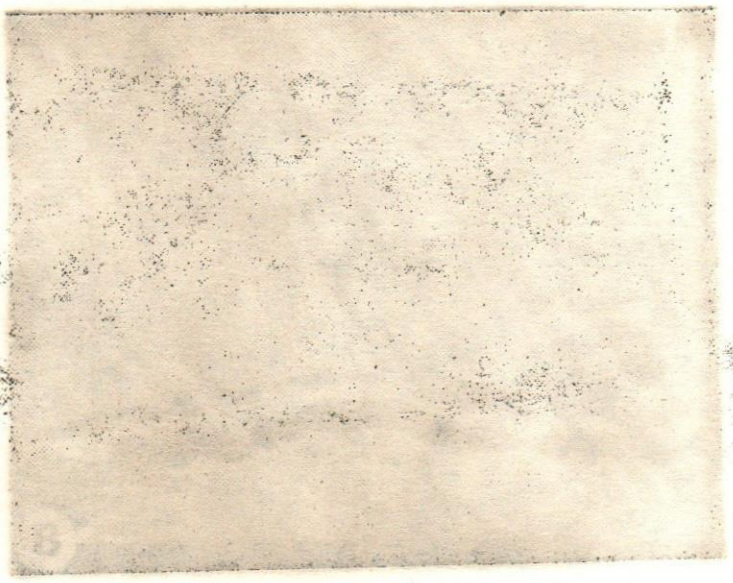

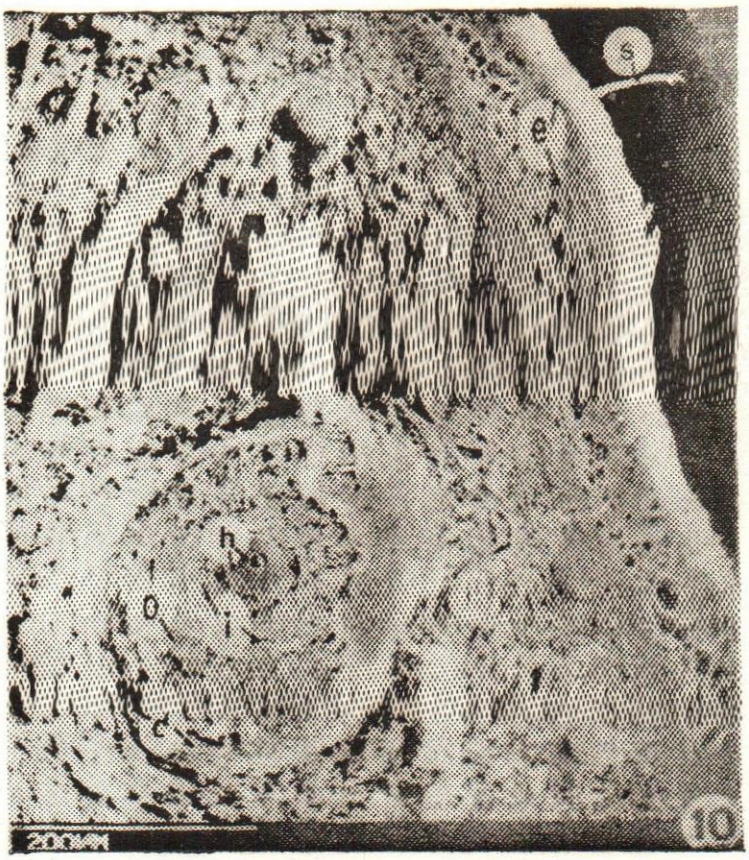
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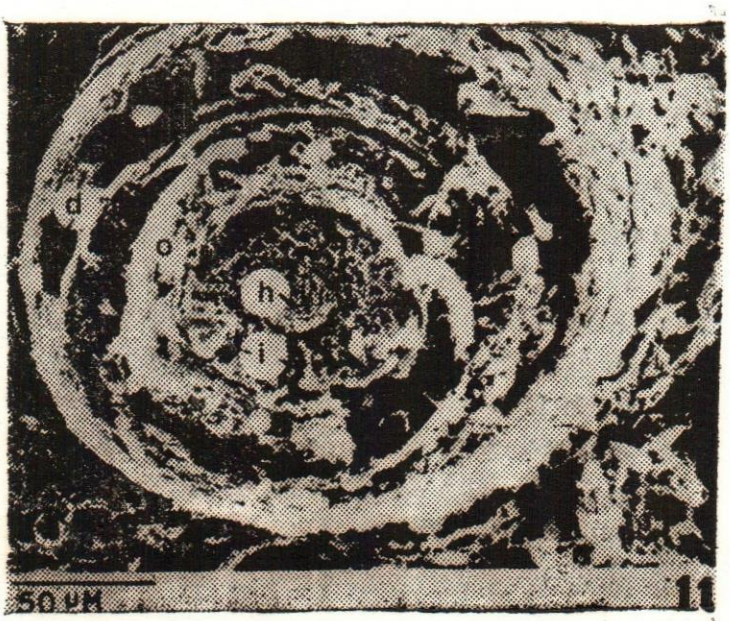
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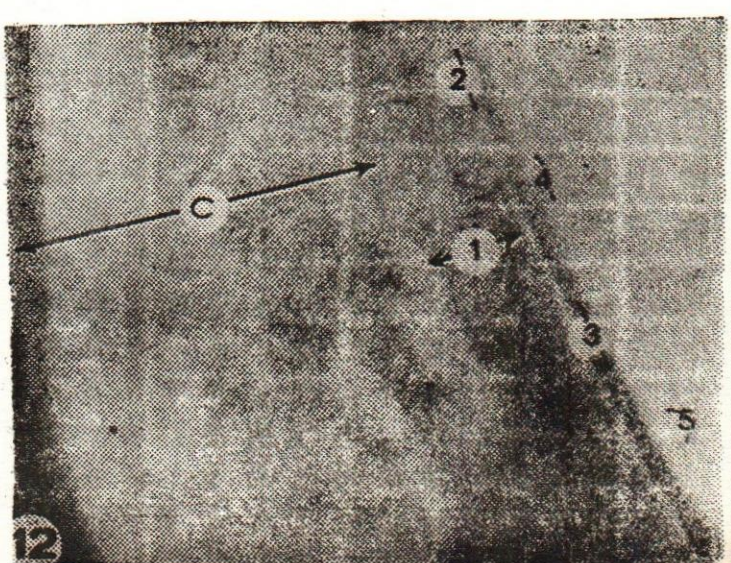
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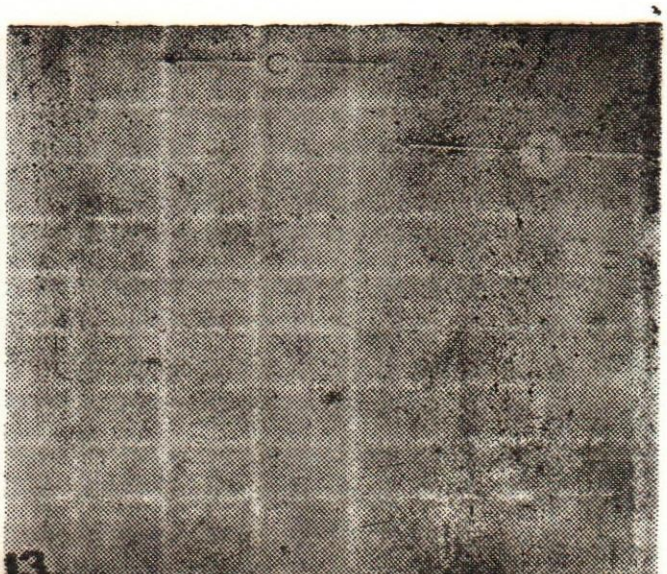
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