THE PATHOLOGY OF OTITIS MEDIA (III) WITH PARTICULAR REFERENCE TO BONE CHANGES*

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APART from its theoretical importance, understanding of the pathology of otitis media assumes a practical form in clinical otology, as the modern approach to treatment and the results of modern treatment are related to an assumed change in the pathology of the disease.

It was with this in mind that the present studies have been undertaken. As has been pointed out in previous reports (Friedmann, 1955 a and b; 1956) no microscopical evidence has been found which might suggest a fundamental change in the pathology of otitis media.

It soon became obvious, however, that a re-investigation of some of the more controversial aspects of the pathology of otitis media might serve some useful purpose. In spite of the immense amount of available literature there appears to exist no general agreement on some fundamental issues involved. And in particular the behaviour and histological pattern of the diseased bone is still in doubt.

In the present report some additional evidence will be presented of the important rôle of bone formation and bone reconstruction and the microscopical features of sclerotic bone will be discussed.

Material and Methods

796 specimens of bone chips removed at operations on the mastoid process in the period April, 1953, to August, 1956, have been systematically examined.

Bone Formation and Bone Reconstruction

The structure of the osseous parts of the middle ear suffers considerable changes in infections of the middle ear. Whereas in the early stages of acute otitis media (or mastoiditis) destructive processes are striving for supremacy, the regenerative efforts of the bone soon begin to assert themselves. As the activity of the osteoblasts increases so the osteoclastic activity decreases, leaving the field to newly-formed bone replacing fibrous

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granulation tissue in the mastoid cells or perivascular spaces of the human mastoid process.

New bone formation, starting early in acute or subacute mastoiditis, may become very active and luxuriant leading to the obliteration of the various cavities of the ear (Figs. 1 and 2).

In chronic otitis media these processes of alternative absorption and deposition may continue, maintained by the irreversible changes of the infected mucosa, recurrent acute exacerbations of the infection and the like.

Bone chips will show microscopical evidence of such repeated alternations of absorption and depositions of bone leading to a reconstruction of the bone pattern. Microscopically this is illustrated in various ways, such as blue staining lines of apposition forming a glacier-like pattern with or without irregular cement lines arranged in a Paget-like mosaic (Figs. 3, 4, 5, 6 and 7).

Discussion of Bone Changes

The bone is usually grossly affected and shows active participation in every phase of otitis media. Bone resorption and bone formation are in a continuous combat. This is more vigorous in acute infections and proceeds at a more leisurely tempo in chronic otitis media. This may depend to a certain degree on the species, or possibly even the strain of the infective organism.

Many earlier authors like Manasse (1917), Krainz (1924), Mayer (1928), Stewart (1928), Ziegler (1936) have furnished convincing enough evidence of new bone formation. Ziegler (1936) has examined bone chips of 100 cases and noted considerable bone formation, often as soon as on the 8th day of the illness. Trabecular bone formation on an average started after about 14 days and reached its peak in the 4th to 8th week of otitis.

Mündnich, 1939, has stated that a partly fibrous, partly osseous obliteration of as much as half the cell system is not only possible but occurs to an extent hitherto unrecognized. More recently Ojala (1952) has expressed the view that sclerotic mastoid processes are almost certainly the result and not the cause of chronic infection. The present studies and in particular experimental evidence previously reported (Friedmann, 1955 a and b) strongly favour this opinion.

It is only fair to mention that many otologists would not accept this view. Yet one cannot help thinking that in their conclusions they are guided more by clinical impressions than histopathological evidence that leaves no doubt of the significance of bone formation and bone pattern.

New bone formation and bone reconstruction must be regarded as fundamental processes of otitis media leading to a change of the whole pattern of the infected mastoid bone. Moreover, there is in the altered microscopical pattern of the sclerotic bone the imprint of bone changes,

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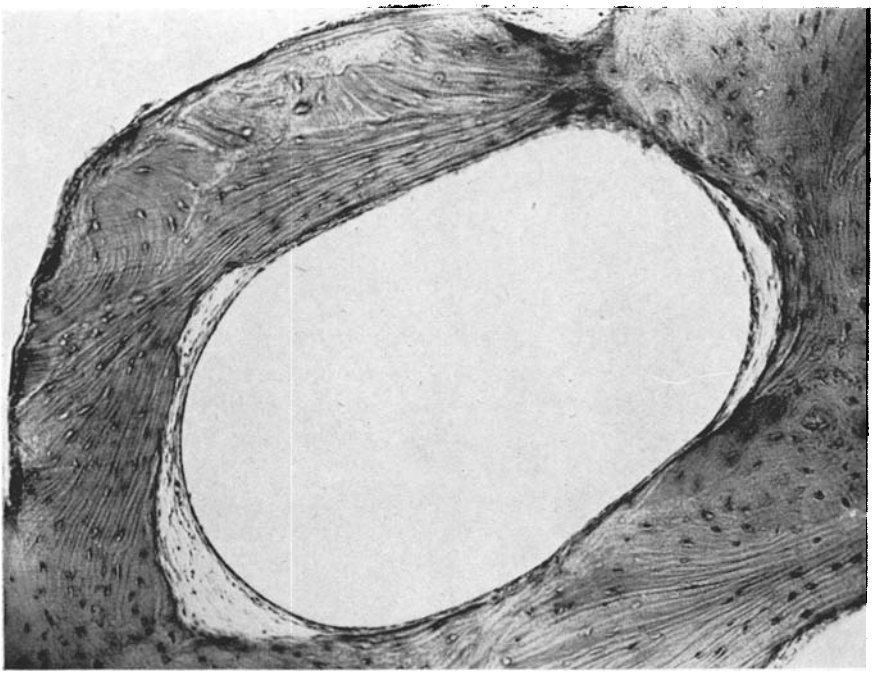


FIG. 1.
Normal mastoid cell. Note flat endothelium-like lining and normal lamellated bone.
H & E. × 150.

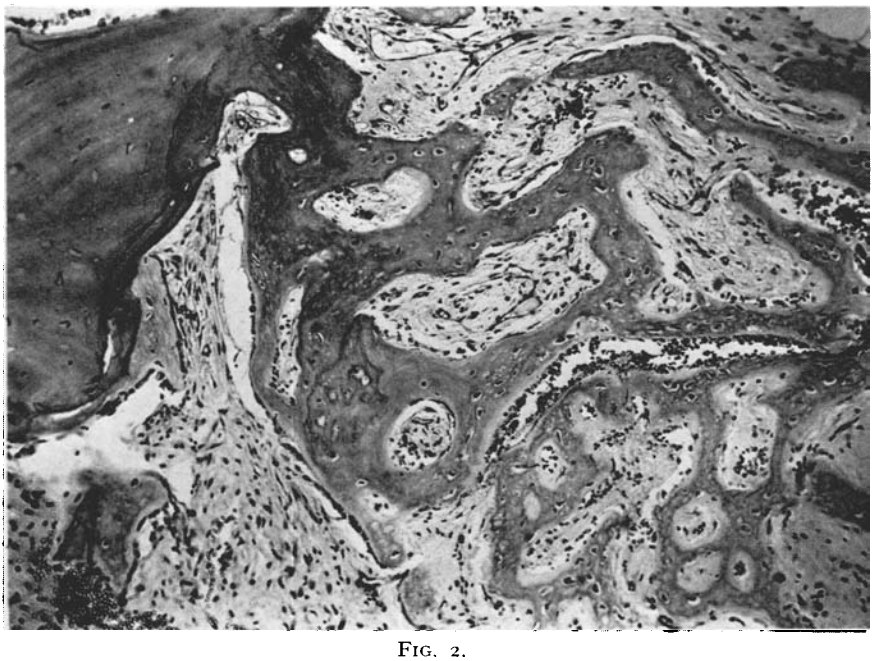


FIG. 2.
Luxuriant new bone formation in subacute mastoiditis.
H & E. × 140.

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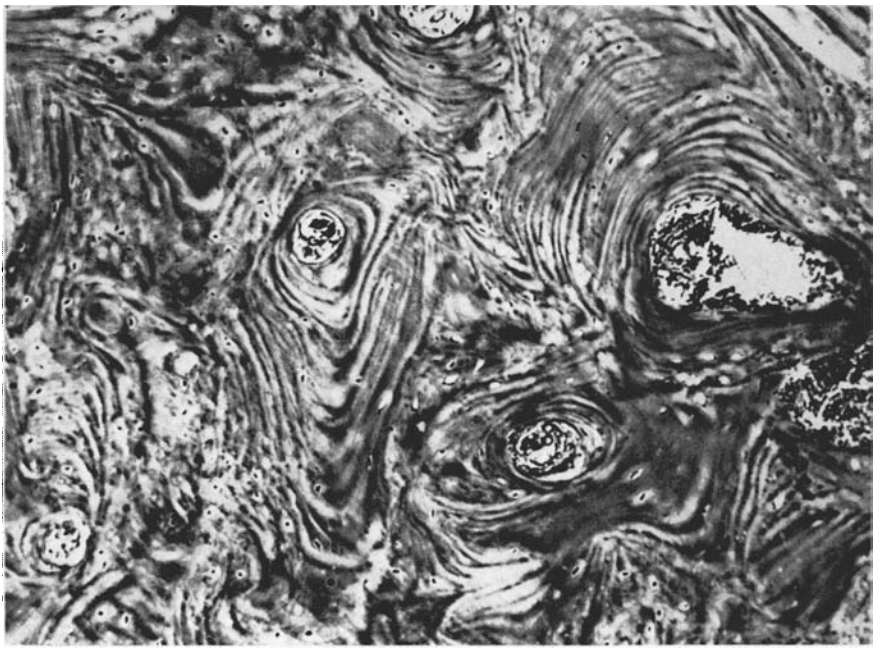


FIG. 3.
Normal compact bone showing Haversian systems.
H & E. × 125.

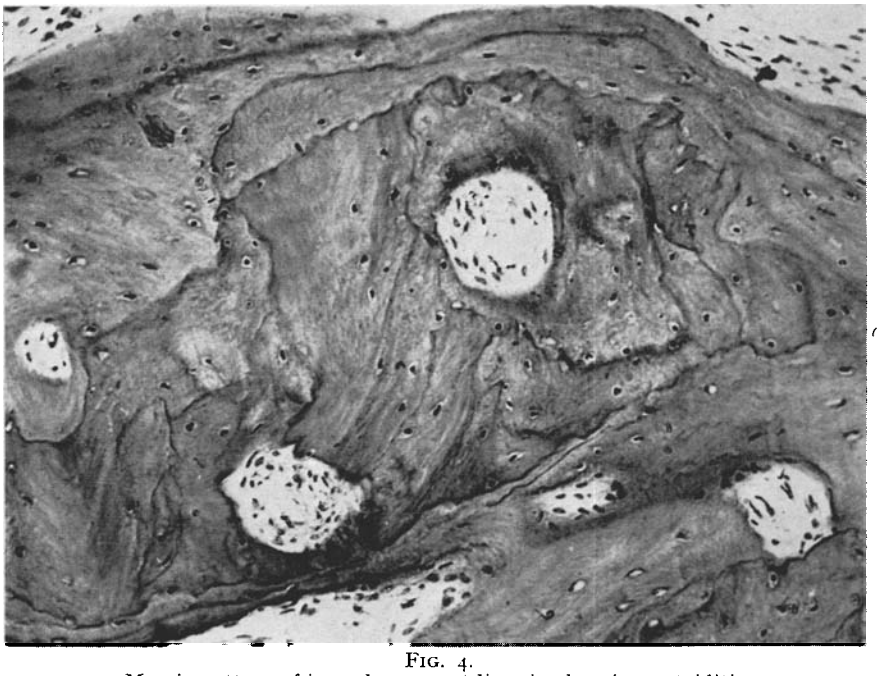


FIG. 4.
Mosaic-pattern of irregular cement lines in chronic mastoiditis.
H & E. × 230.

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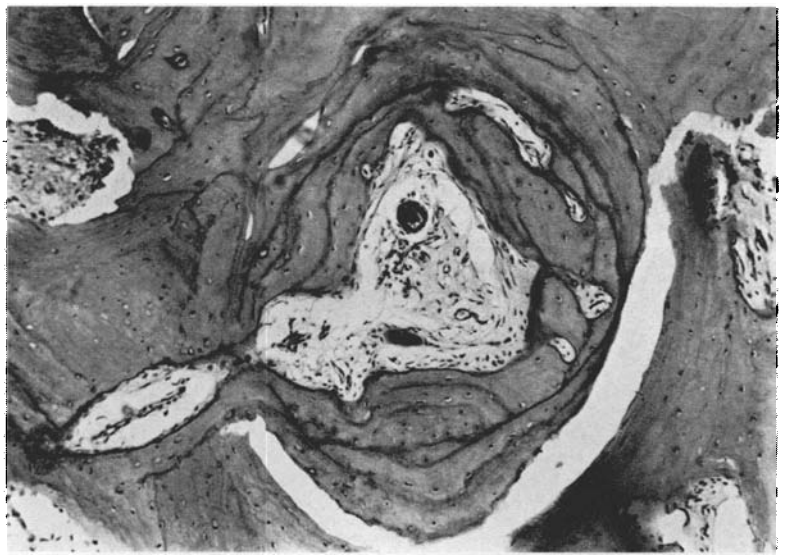


FIG. 5.
Mosaic pattern of irregular cement lines in chronic mastoiditis.
H & E. × 105.

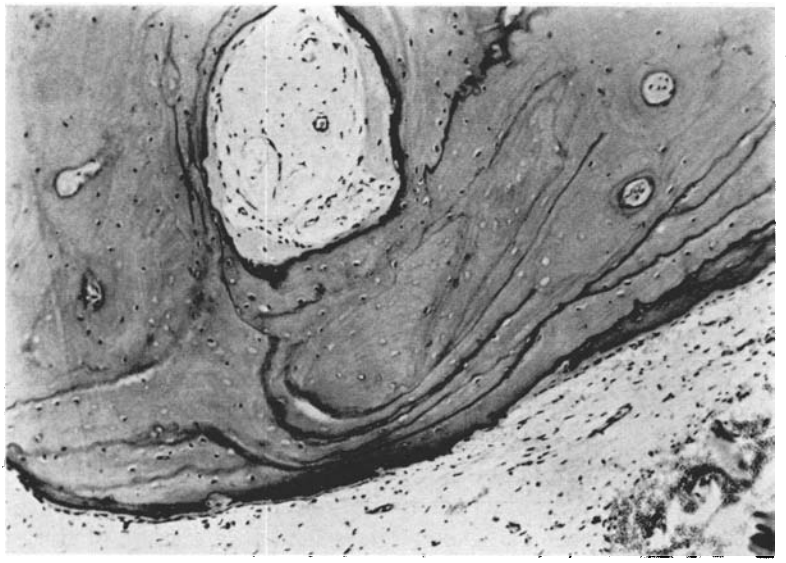


FIG. 6.
Lines of apposition forming glacier-like pattern in chronic mastoiditis.
H & E. × 108.

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which makes differentiation of sclerotic bone, with its irregular pattern, from compact bone, with its regular Haversian systems of lamellar bone, reasonably accurate.

Histological types of mastoid bone

The present studies have not been directly concerned with the problem of pneumatization. But the evidence presented suggests some conclusions regarding the various types of mastoids.



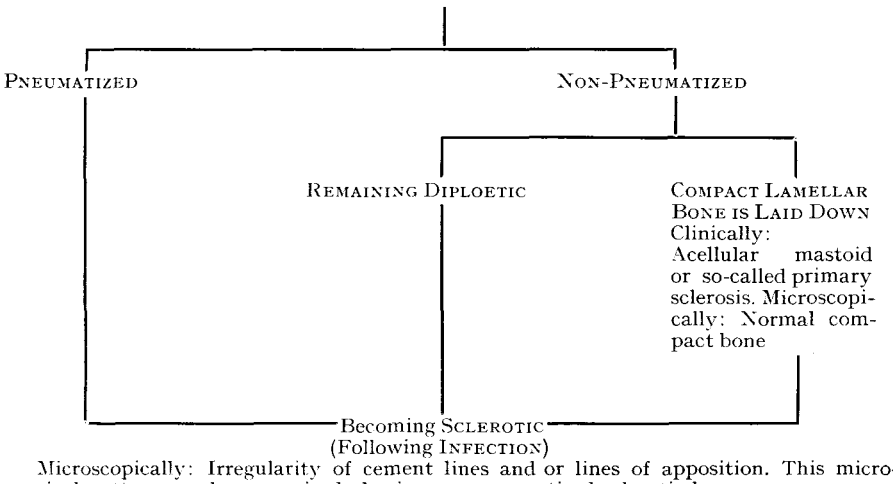
FIG. 7.
Fragment of sclerotic mastoid bone with air cell. Note irregular cement lines.
H& E. × 130.

The infantile mastoid process normally becomes pneumatized. If pneumatization is arrested the bone remains diploetic (Cheatle's infantile diploetic type) and may become converted into compact bone through the physiological process of lamellar bone being laid down in the marrow spaces. The result will be an acellular mastoid process clinically and radiologically. Microscopically, however, it will differ from sclerotic bone which is the result of bone reconstruction due to repeated and alternating absorption and deposition of bone. These lead to a change of the microscopical pattern which can be readily recognized (Friedmann, 1956). Infection occurring in any of the normal types of the mastoid bone, pneumatized, infantile diploetic or compact, may convert it into a sclerotic one in the histopathological sense (Table I).

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TABLE I.

HISTOLOGICAL TYPES OF MASTOID BONE



Microscopically: Irregularity of cement lines and or lines of apposition. This microscopical pattern can be recognized also in a re-pneumatized sclerotic bone.

Re-pneumatization, usually limited in scope and patchy, may explain why the structure of a "sclerotic" mastoid process may not always appear acellular at operation.

Conclusions

New bone formation and bone reconstruction are fundamental processes of otitis media leading to a change of the histological pattern of the infected mastoid bone converting it into sclerotic bone.

Microscopical signs of inflammatory sclerosis of the mastoid bone have been described. These and experimental evidence have been interpreted as evidence that sclerotic as opposed to compact mastoid bone is the effect of chronic infection of the middle ear.

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