

The Bone Lesions in Leprosy

A Study Based on Microradiography and Fluorescence Microscopy

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Bone lesions in leprosy are known mainly from routine X-ray pictures supplemented by histologic investigations (¹). The present study is based on the application of microradiography and fluorescence microscopy after *in vivo* labeling by tetracyclines. Consideration of the dates of tetracycline injections, and of the examination of the fluorescent picture and of the corresponding microradiograph, brings new data on the evolution of bone lesions in leprosy.

Amputation material has been provided from 40 leprosy adults. Some specimens

have been discarded because they were suspected of superadded infection. The results are described according to gross morphologic characteristics. We shall consider first the simple destruction, then the isolated bone formation, and finally the conditions in which these two aspects are combined.

The microradiograph of a phalanx of a tuberculoid leprosy patient (Fig. 1), shows in transverse section that the remodeling is almost normal. [For the latest survey on the subject, see Lacroix (²). As a matter of fact, this paper is part of a team-work research program on bone remodeling.] Most of the osteones show normal bone deposition and complete mineralization; some of them, however, have a large canal

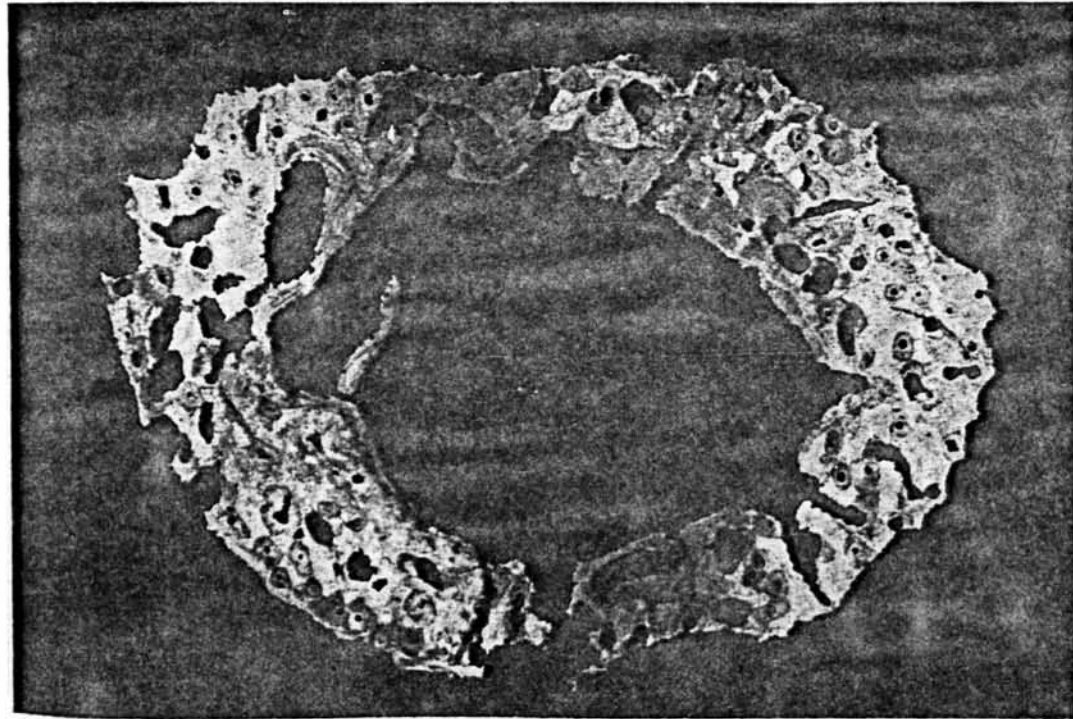


FIG. 1. Microradiograph of a transverse section of a phalanx (evolutionary tuberculoid leprosy).

and are poorly mineralized. On the other hand, we note an internal and a peripheral erosion which destroys the normal shape of the cortex by numerous disseminated osteoclastic lacunae. Large cavities are found in the compact bone without any sign of local reconstruction.

Another general picture (Fig. 2), shows a cross-section from a tuberculoid leprous phalanx. The peripheral and endosteal erosion is evident. The destruction cavities are numerous, merging into each other; they differ from resorption cavities of normal remodeling by their dimensions and by the absence of reconstruction. Their edges are festooned by numerous lacunae, which are the traces left by the action of osteoclasts. In longitudinal section (Fig. 3), this difference seems quite clear. We can distinguish the regular aspect of the haversian canal, bored from that of the cavities which are being destroyed and not rebuilt.

Let us consider now the pathologic bone deposition without previous destruction. A subject had received an injection of tetracycline the day before the amputation. In cross section of a metatarsal diaphysis (Figs. 4 and 5), fluorescence brings out a slow lamellar endosteal deposition and exuberant bone production at the periphery of the bone. The aspect is identical at the metaphyseal level. At a higher magnification (Figs. 6 and 7), we see that the fluorescence has labeled the pathologic deposition, which is unusual and lacy.

When several injections of tetracycline have been given, the pictures are more interesting. In the case illustrated in Figs. 8 and 9, i.e., the case of an adult patient in whom bone deposition should have ceased normally, there was, some months before, a slow and regular deposition of lamellar bone of normal aspect, but the last labeling corresponds to an irregular and exuberant periostosis. These stages are read by reference to the contemporary and regular labeling of the osteones observed in the compact bone.

Strange aspects are sometimes recorded in newly deposited osteones. In the case illustrated in Figs. 10 and 11, bone deposition was normal at first; then, about three months before amputation (date provided

by the buried fluorescent ring), new bone became abnormal, irregular with large osteocyte lacunae. In other cases (Fig. 12), the process of osteone formation is excentric, as it is in adolescents.

Most of the time, leprous lesions show in the same field aspects of destruction and of reconstruction, both differing from the normal.

Figs. 13 and 14 illustrate a lepromatous phalanx from a subject labeled, three months before, with tetracycline. They are good examples of complex lesions. The microradiograph shows, in white, the bone present three months before amputation, and, in grey, the bone deposited during the last three months. This statement, and this accurate dating, would not have been possible without the aid of the fluorescent picture.

Routine X-ray examination very often reveals a progressive reduction in the size of phalanges, metacarpals and metatarsals and this important clinical observation deserves being well documented: A first case is illustrated by Figs. 15 and 16. Fig. 15 is the radiograph of a metatarsal. Four arrows indicate the levels of the four microradiographs of Fig. 16. The medullary cavity is partly filled by layers of lamellar bone. The haversian remodeling of the compact bone does not seem to be altered.

Another case comes from a leprous phalanx sectioned transversely at four levels (Fig. 17). Peripheral erosion is very active here. Furthermore, the medullary cavity is being filled by a double process: deposition of concentric layers of normal, but lightly mineralized lamellar bone, followed by an unusual type of bone tissue, which is without equivalent, as far as we know, in bone pathology. In order better to exemplify this latter type of bone tissue, Figs. 18 and 19 have been selected from a longitudinal and from a transverse section.

To end this presentation, some additional pictures provided by subjects labeled with tetracycline may be noted. Figs. 20 and 21 come from a patient labeled the day before amputation. Fluorescence microscopy catches the process of centripetal deposition of lamellar bone. Note the intense resorption at the periphery. In the case of the

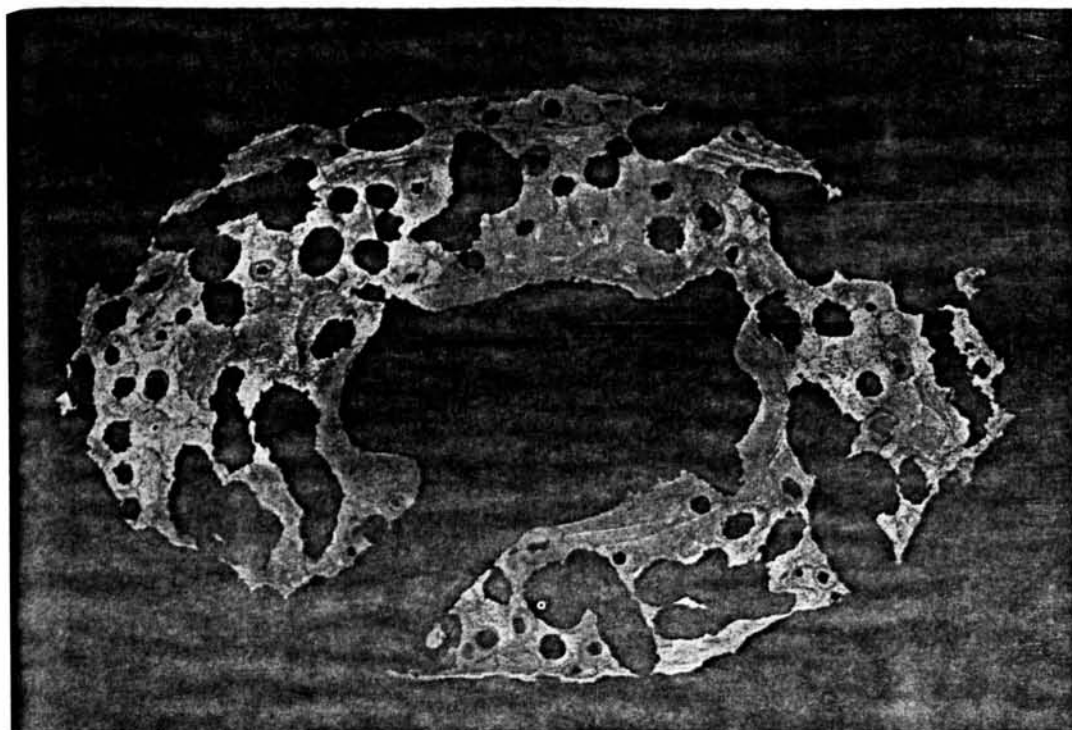


FIG. 2. Microradiograph of a transverse section of a phalanx (old lepromatous leprosy).



FIG. 3. Microradiograph of a longitudinal section through a normal haversian canal and a pathologic cavity.

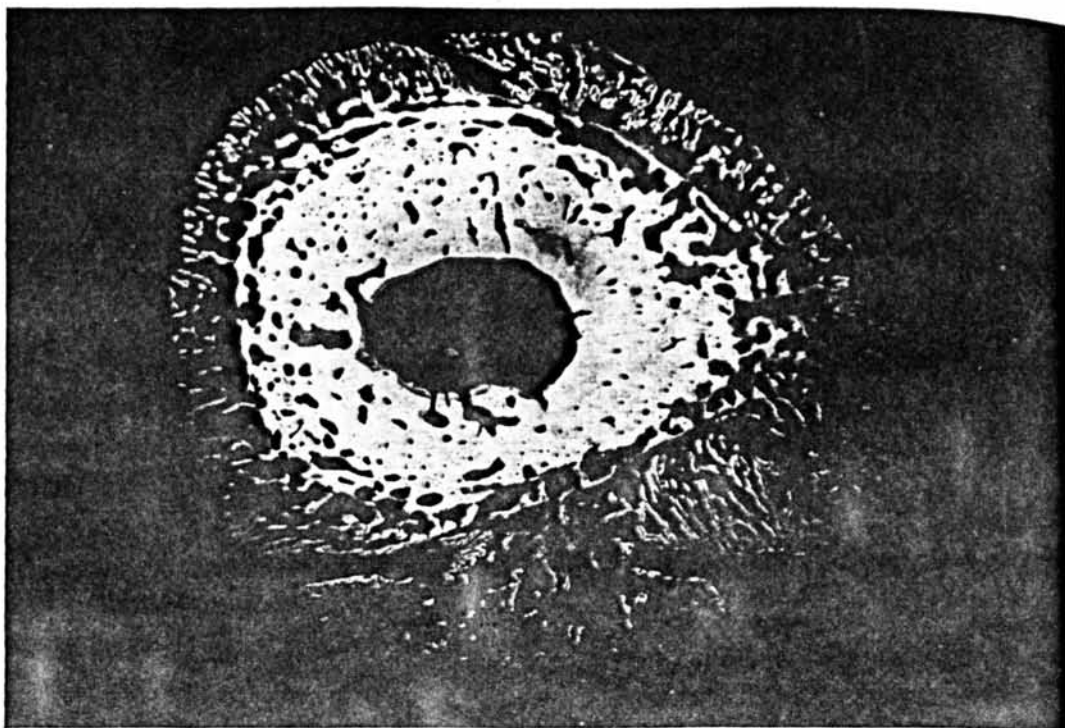


FIG. 4. Microradiograph of a transverse section of the diaphysis of a metatarsal bone from an evolutive lepromatous lesion.

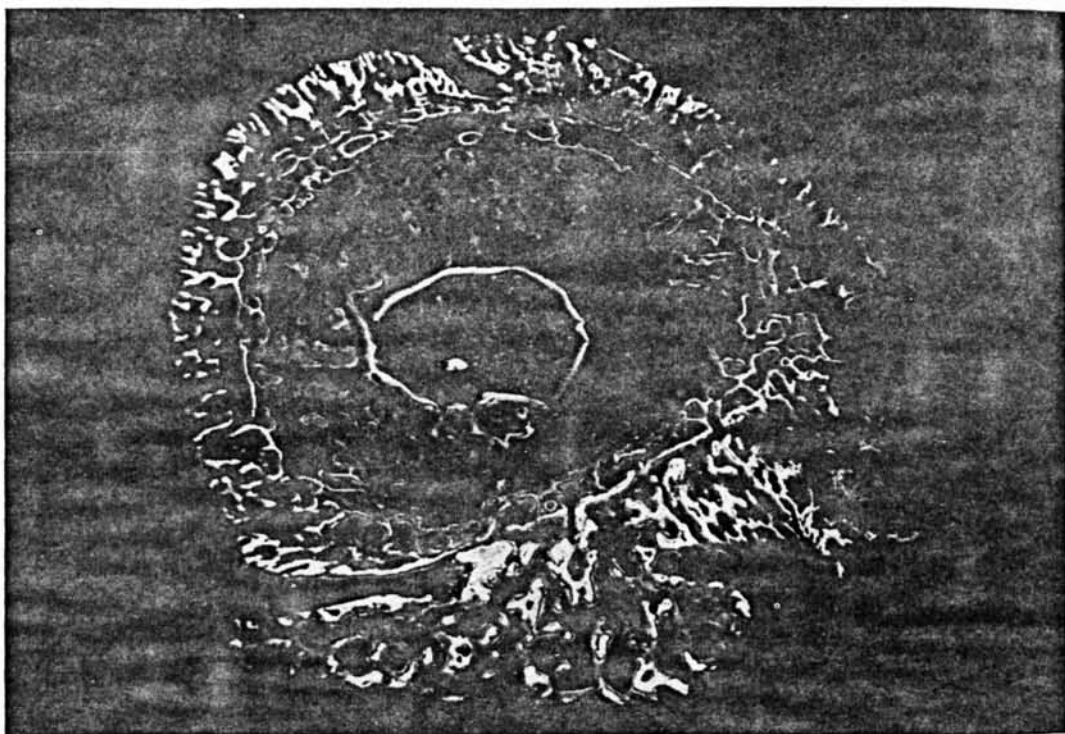


FIG. 5. Fluorescent aspect of the same section. The subject had received tetracycline the day before amputation.

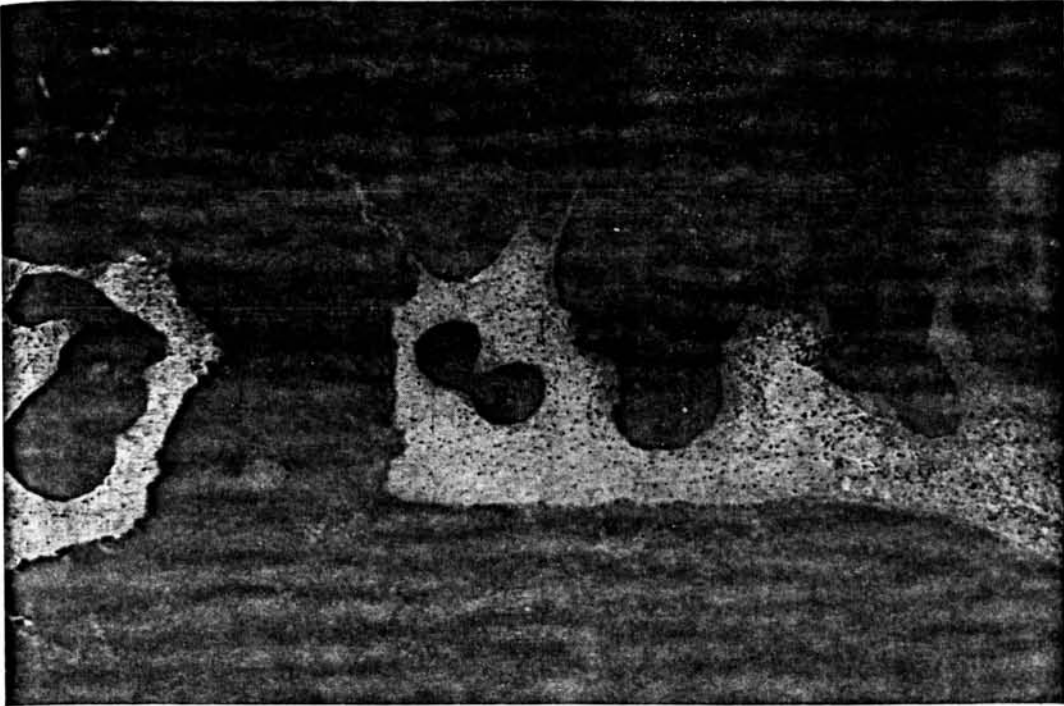


FIG. 6. Microradiograph of a transverse section at the metaphysial level of a metatarsal.

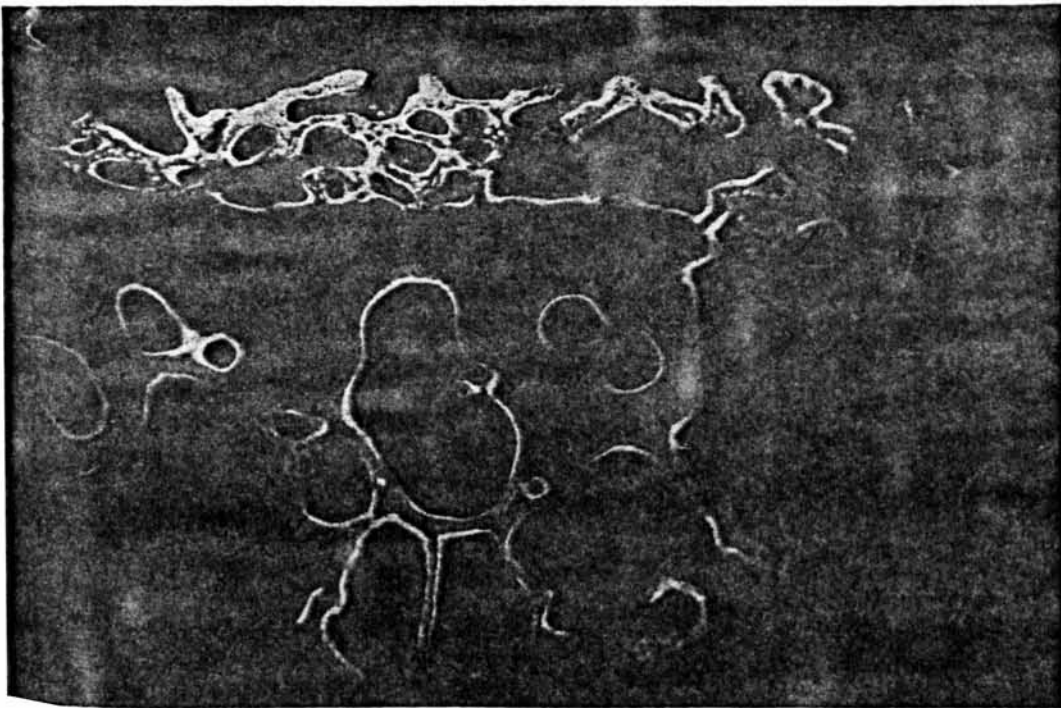


FIG. 7. Fluorescent aspect of the section shown in Fig. 6. The subject had received tetracycline one day before amputation.

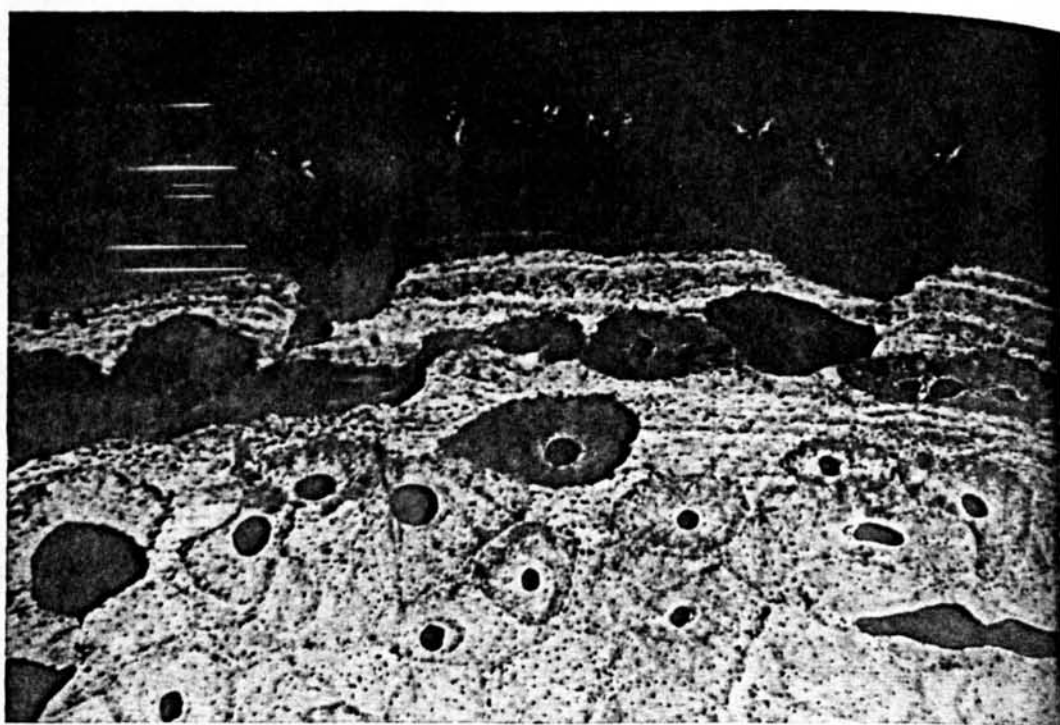


FIG. 8. Microradiograph of the periphery of a transverse section of a metatarsal of a stable leprosy patient.

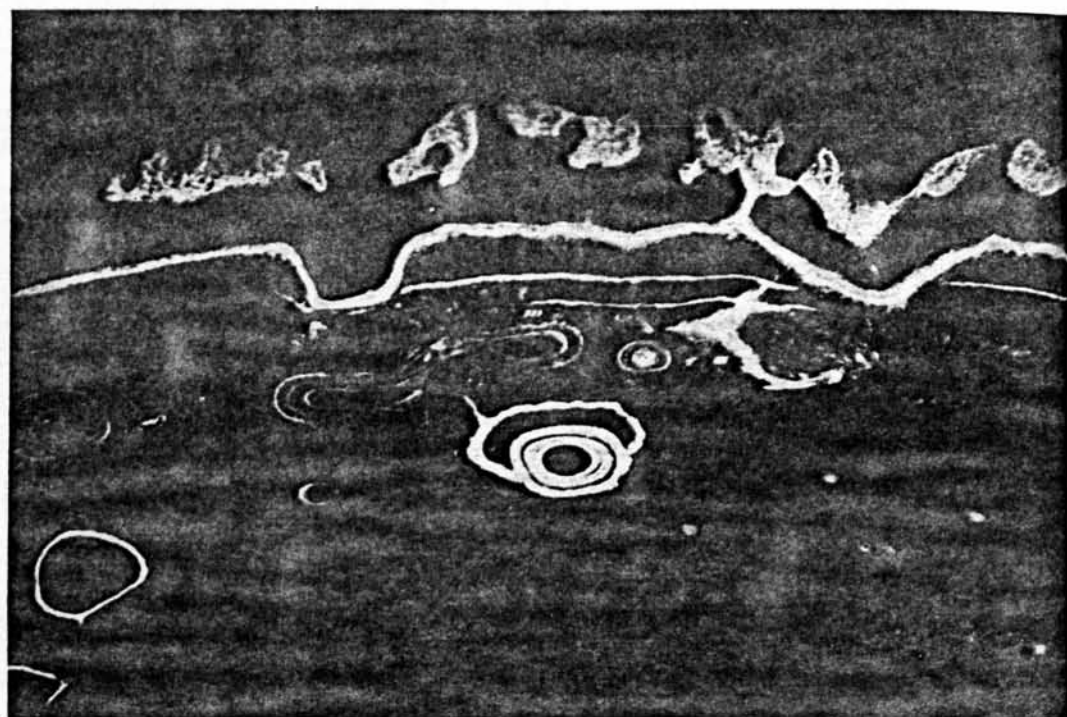


FIG. 9. Fluorescent aspect of the same section (Fig. 8). The subject had received tetracycline injections several times before.

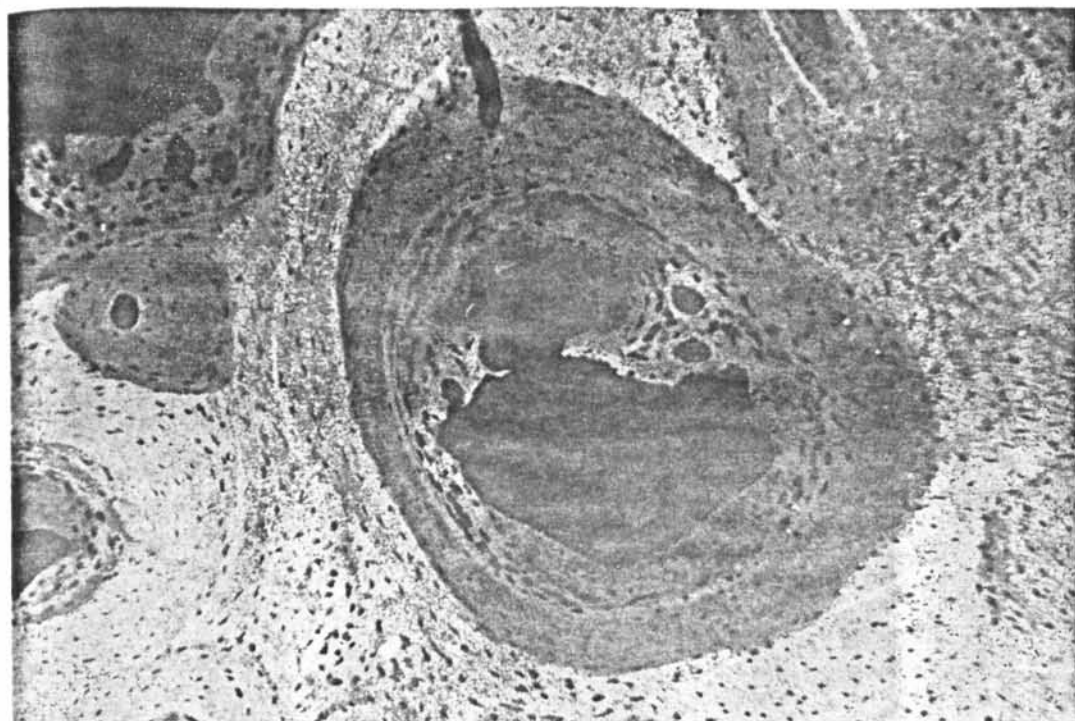


FIG. 10. Microradiograph of a pathologic osteone.

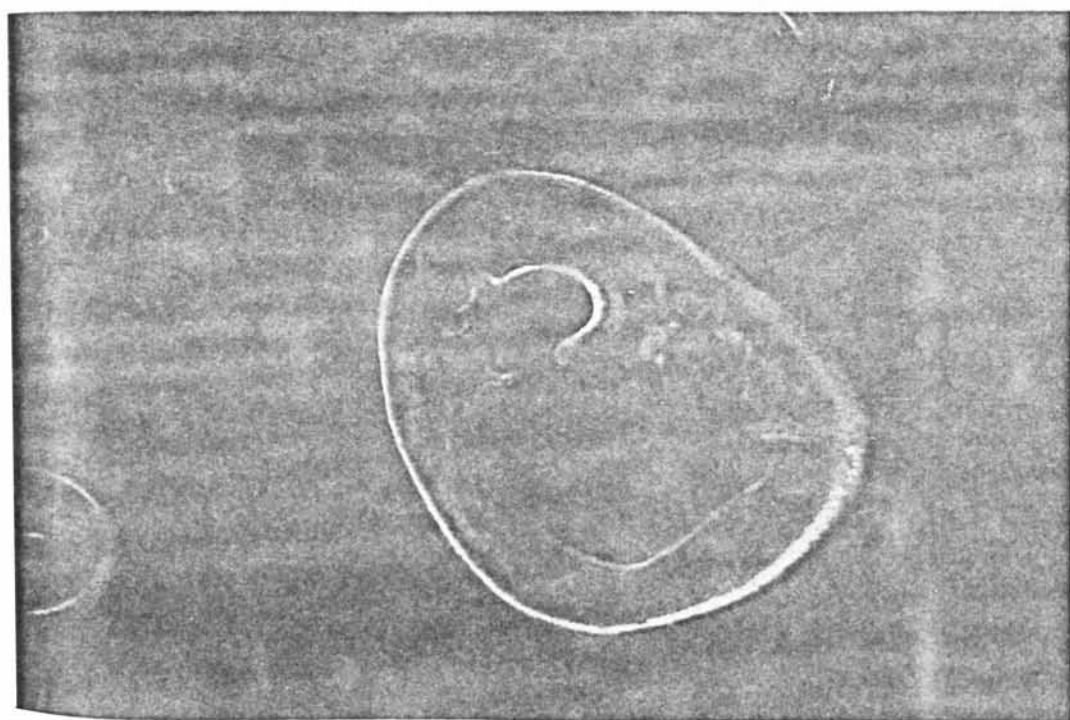


FIG. 11. Fluorescent aspect of the same section. The subject had received two injections of tetracycline, one three months before and another three days before amputation.

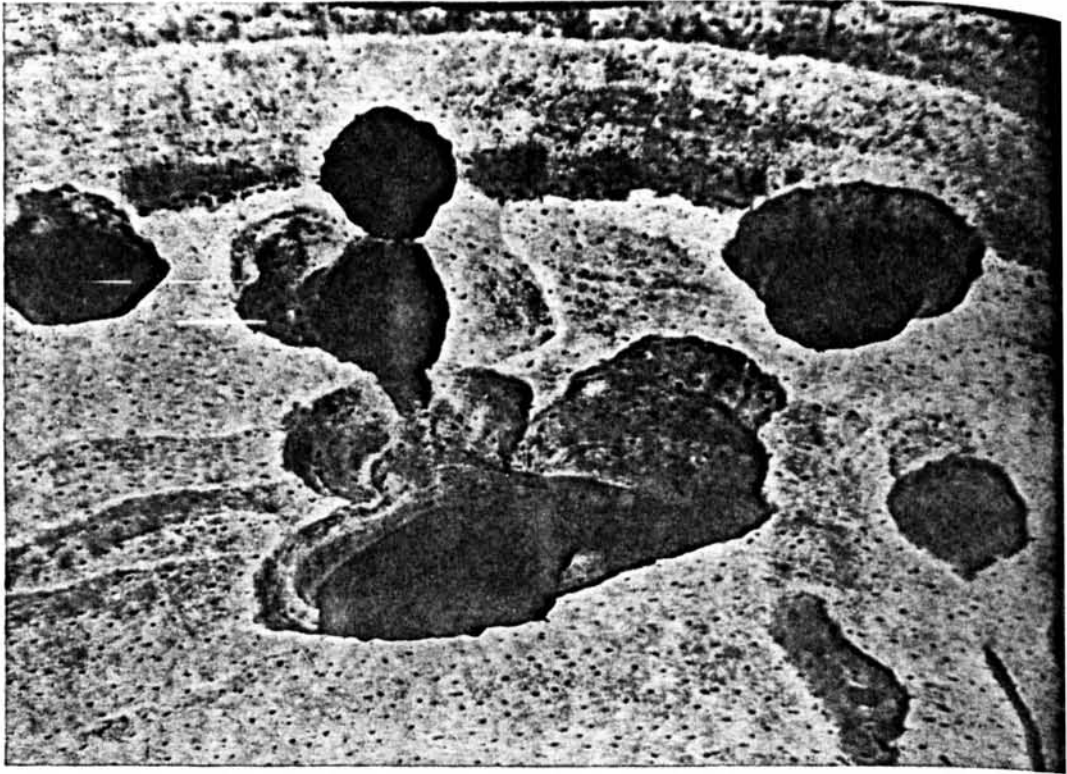


FIG. 12. Microradiograph of excentric osteones.

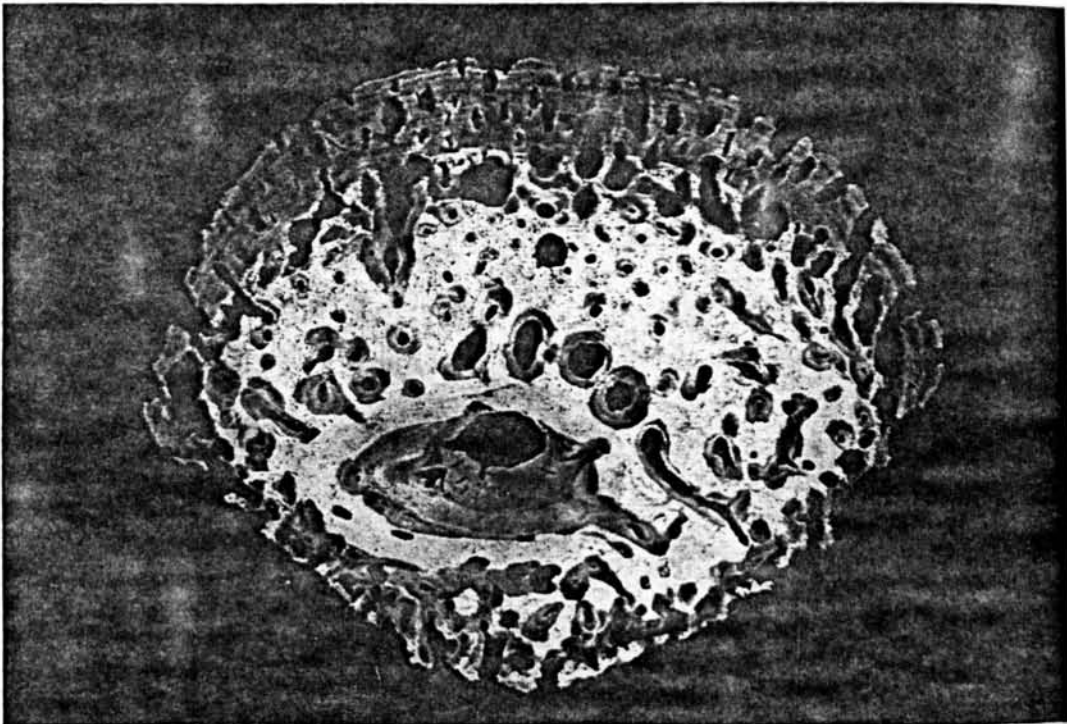


FIG. 13. Microradiograph of a transverse section of a phalanx (old stabilized lepromatous leprosy).

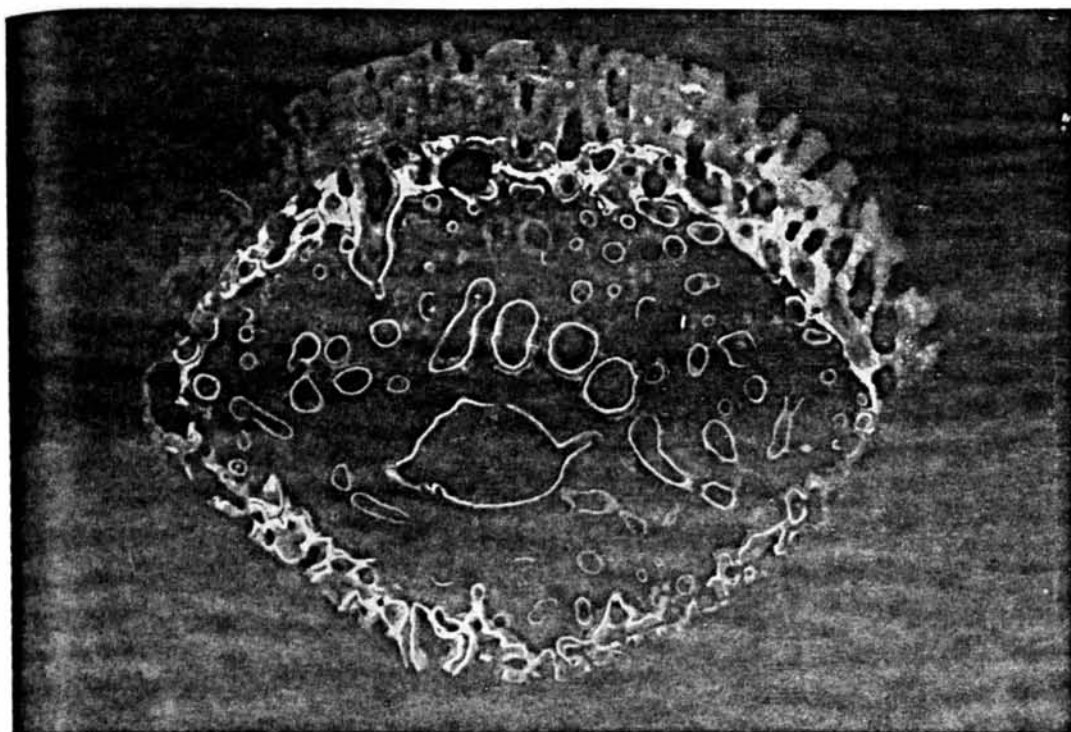


FIG. 14. Fluorescent aspect of the same section. The subject had received tetracycline three months before amputation.

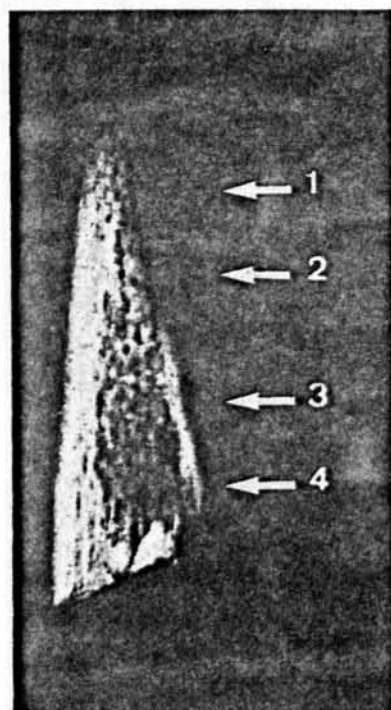


FIG. 15. Radiograph of a metatarsal (leptomatous).

patient illustrated in Figs. 22 and 23, tetracycline had been administered three months before. Here the labeled layer is deeply buried under the more recently deposited layers. Haversian remodeling is characterized by the formation of excentric osteones.

SUMMARY

To the best of our knowledge, the present study is the first to take advantage of the technical possibilities offered by microradiography and fluorescence microscopy in the study of bone lesions in leprosy.

We show here a variety of documents which correlate the well-known pictures of routine X-ray observation with those recorded at the microscopic level.

In some cases either bone destruction or bone formation is observed as an isolated phenomenon. In most cases the two phenomena are intermingled.

In addition some aspects indicate that bone lesions in leprosy include a qualitative alteration of the new bone being produced.

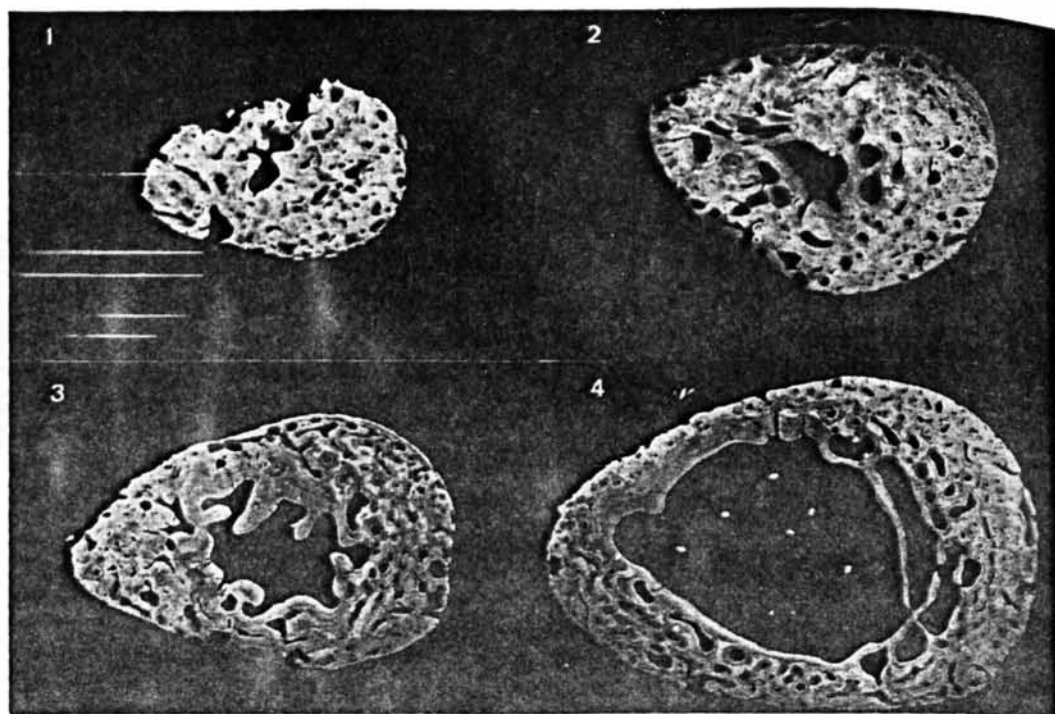


FIG. 16. Microradiograph of transverse sections at the levels indicated in Fig. 15 by four arrows.

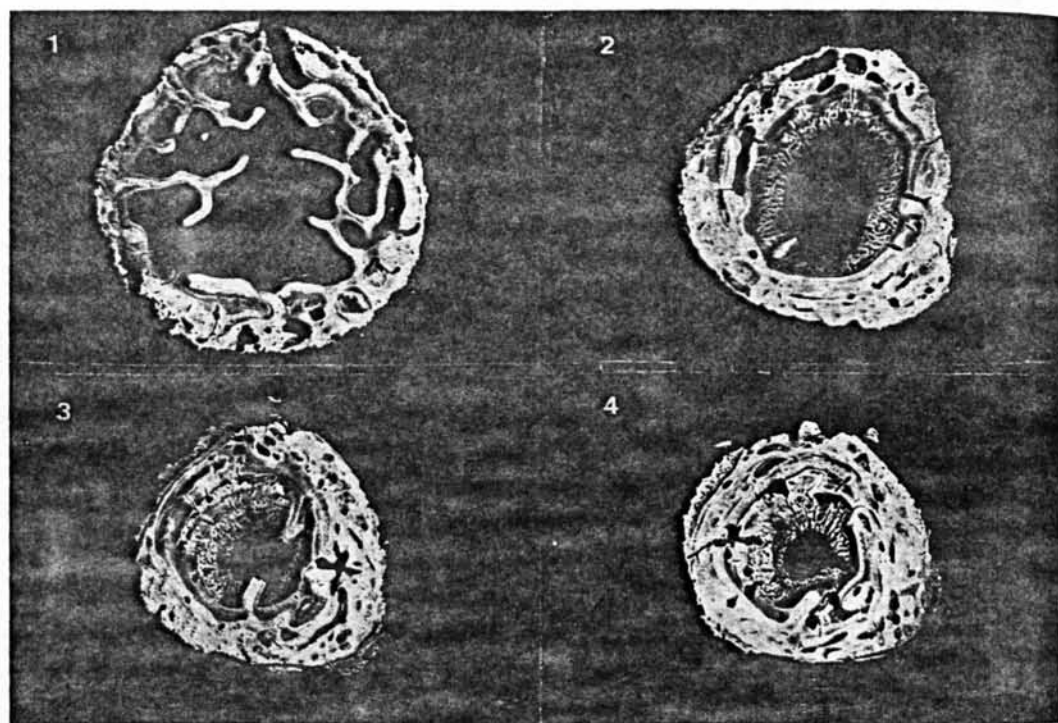


FIG. 17. Microradiograph of four transverse sections at different levels of a metatarsal (evolutionary lepromatous leprosy).

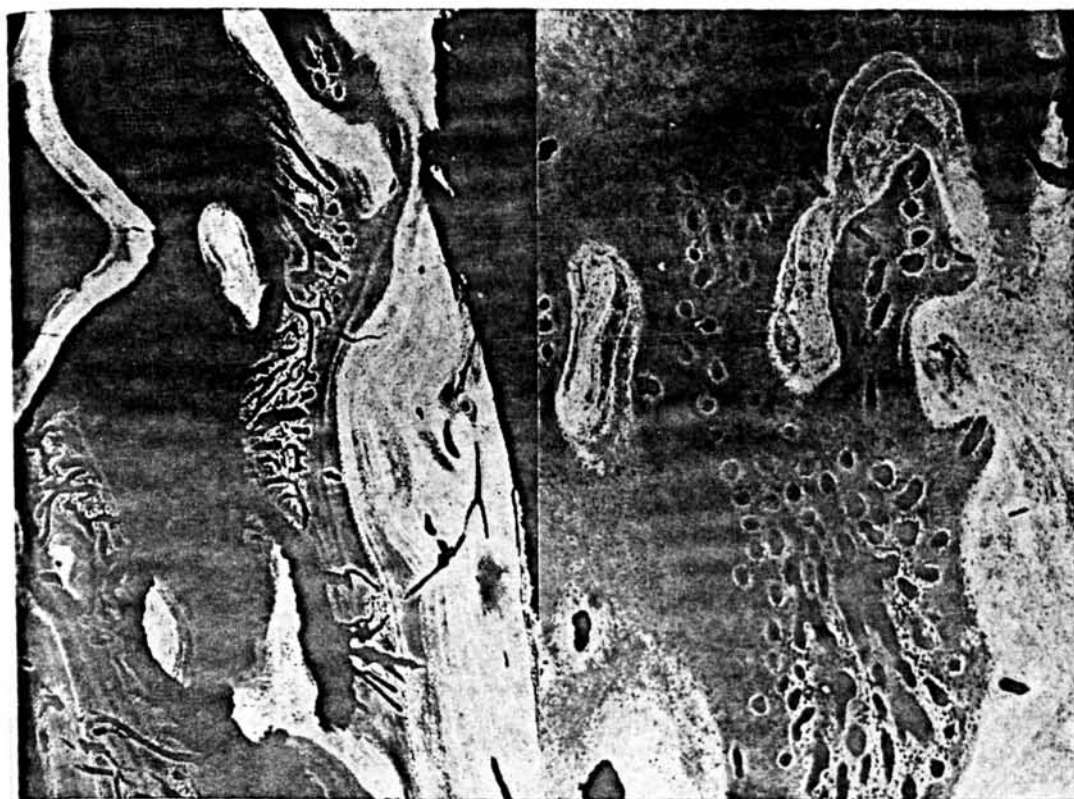


FIG. 18. Enlargement of Fig. 17. Micro-radiograph of a longitudinal section.

FIG. 19. Enlargement of Fig. 17. Micro-radiograph of a transverse section.

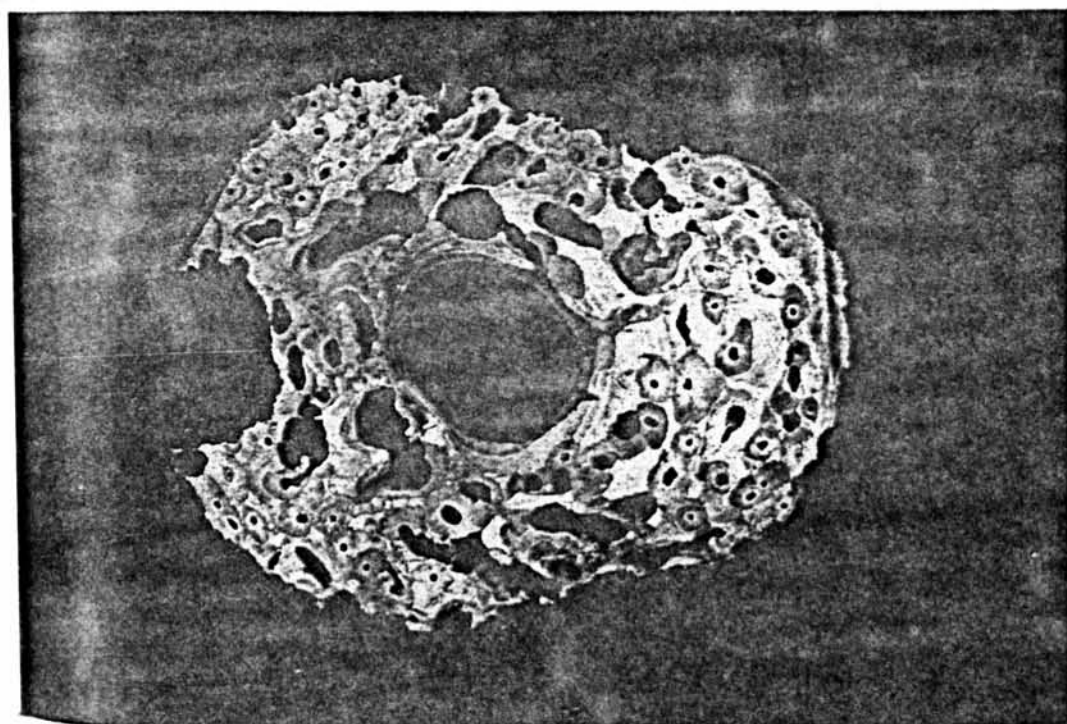


FIG. 20. Microradiograph of a transverse section of a phalanx (tuberculoid female patient 60 years old).

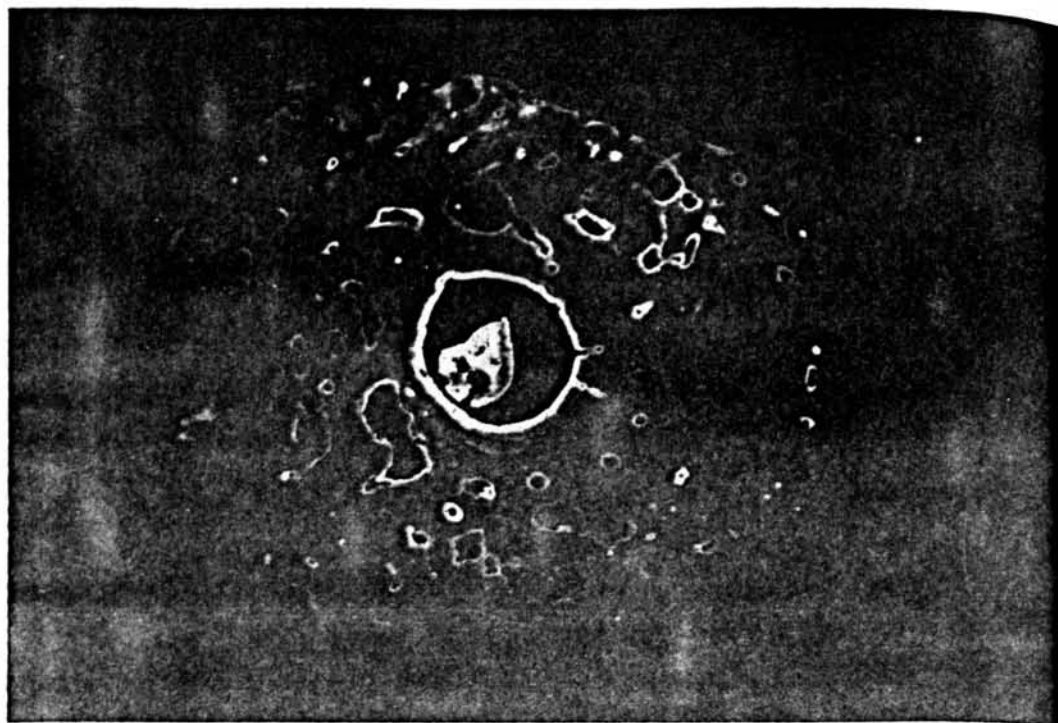


FIG. 21. Fluorescent aspect of the same section as in Fig. 20.

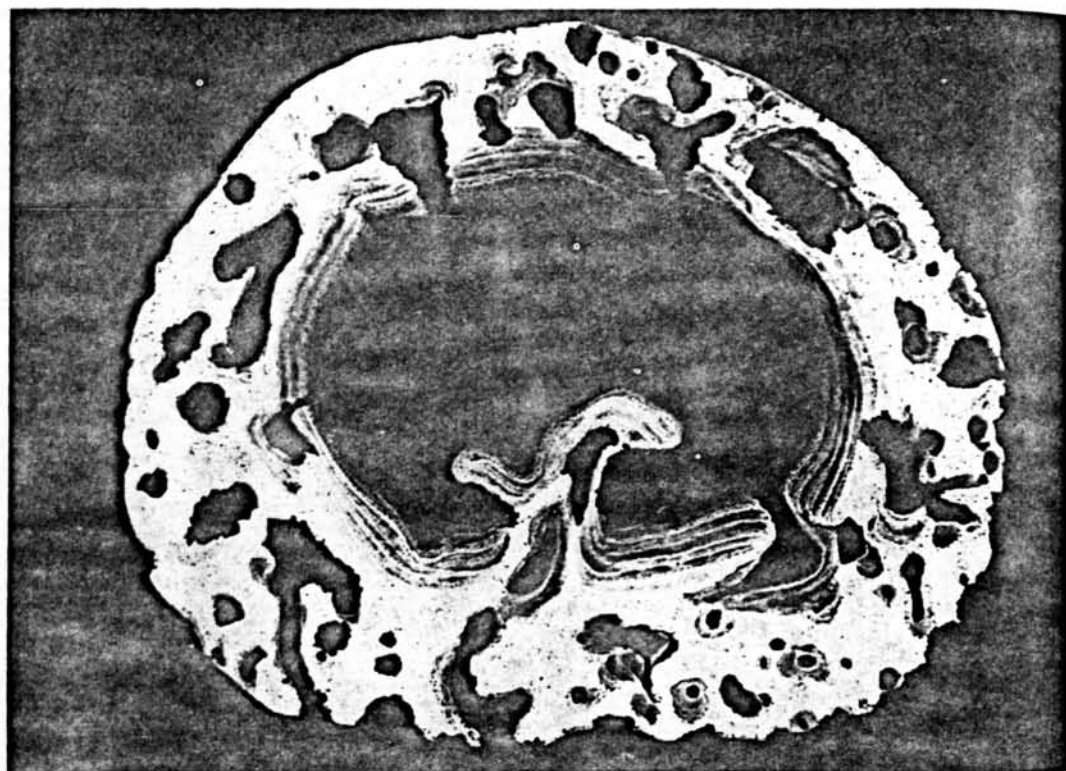


FIG. 22. Microradiograph of a transverse section of a phalanx (old stabilized lepromatous leprosy).

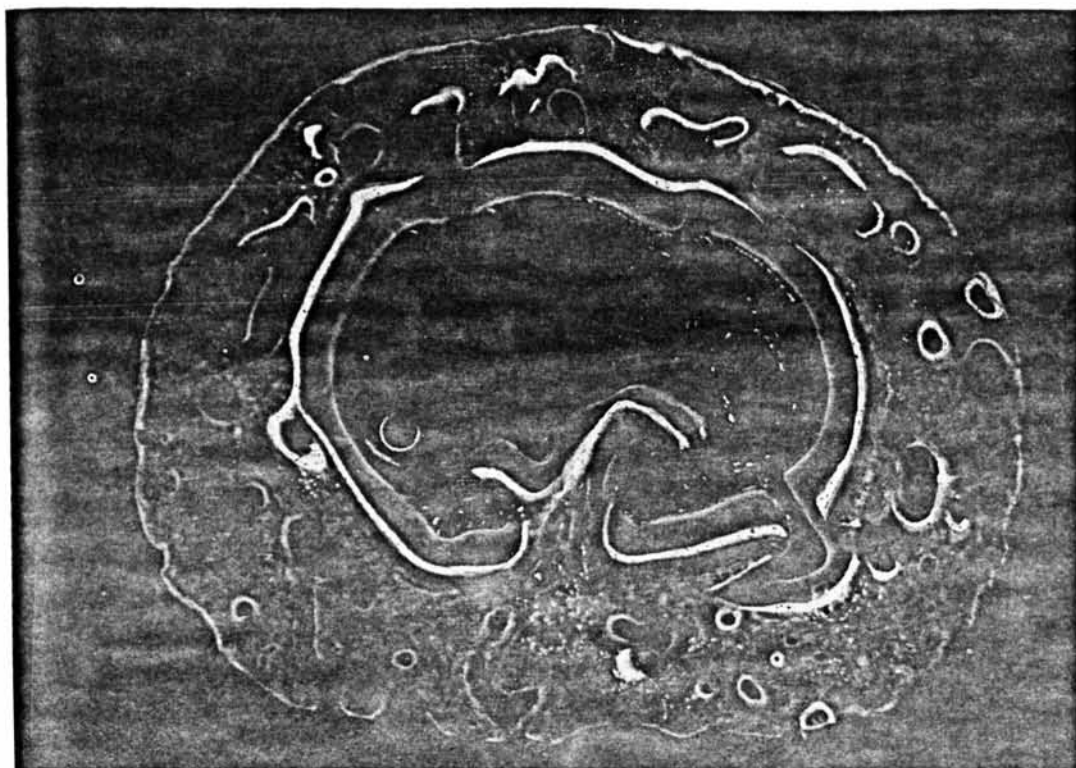


FIG. 23. Fluorescent aspect of the same section as Fig. 22. The subject had received tetracycline three months before amputation.

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2. LACROIX, P. Recherches sur le remaniement des os.—*Arch. Biol. (Liège)* **81** (1970) 275-304.