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山东青岛早白垩世木化石一新种

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本文研究的材料系青岛市博物馆采自山东省青岛市附近即墨县城西10 km马山西麓，确切层位不明。由张福臻馆长选取小块送交鉴定。其完整标本现陈列于青岛市博物馆。

当前的标本是一过矿化(渗矿化)(permineralized)的树干化石，长7 m；上下两端的直径分别为65及75 cm，略扁；成分硅质；呈灰黄色。磨片后在显微镜下观察，发现化石保存良好，特征明显，系南洋杉型木属(*Araucarioxylon*)的一新种，可能为白垩纪的产物，特予报道。

即墨县城附近素产中生代木材化石，徐仁教授(1953)报道过 *Dadoxylon* (*Araucarioxylon*) cf. *japonioum Shimakura* 及其所含菌丝。本文为该区木化石的又一报道。我们希望在不久的将来能有机会对即墨化石林作进一步的研究。

一、描 述

***Araucarioxylon jimoense* sp. nov。**

（图版I，1—4；图版II，1—4）

当前的木化石茎干，呈灰黄色，为二氧化硅等所渗矿化，保存部分为木质部及髓。皮层已脱落，其初生木质部及髓因保存欠佳，未能详加研究。当前描述的是次生木质部的形态。

横切面：次生木质部的轴向成分仅见管胞，无导管。年轮明显，各轮宽度颇有变异。春材发育，约36个细胞宽，管胞近方形，一般为30 × 32 μm，最大的达40 × 48 μm。秋材狭窄，仅2个细胞宽，管胞小而扁，长方形至方形，壁厚，一般大小约为30 × 15 μm。切片中未见树脂道及明显的木薄壁细胞，射线明显，其水平壁光滑，端壁薄；射线间距为2—11细胞，平均为6细胞。

径切面：管胞径向壁具南洋杉式缘壁孔，单行排列，偶夹双行。其单列的壁孔多为上下相接，排列紧密，且或多或少地呈扁椭圆形，不占管胞的全宽。双列的现象极少，仅偶夹于单列之中，呈交互排列，圆或微多边形。纹孔大小约为18 μm，纹孔口圆或椭圆形，椭圆形者多微斜，直径约4—7 μm。在切面中未见三列纹孔和眉条。射线细胞大致呈砖形，壁较薄，其径向长度可达高的3—4倍，跨越管胞4条左右。横壁和弦壁光滑，交叉场内有卵形小孔3—18个，斜向排列，直径3—5 μm。

弦切面：在弦切面中，射线细胞显得多而密，每平方毫米内平均有射线细胞204个，单列，高2—25细胞，平均9个细胞高。射线细胞椭圆形，高约20 μm，宽18 μm。管胞弦向壁光滑，未见壁孔。

二、讨 论

当前的材料具下列特征：管胞径向壁具南洋杉式基本单行的纹孔；射线亦为单列，射线细胞横壁及端壁平滑，交叉场具3—18个卵形小孔；无树脂道及木薄壁细胞等，代表着 *Araucarioxylon* 属的木材。*Araucarioxylon* 是一个分布极广的属：地理上遍及南、北半球；地质上兼及于古、中生代。在东亚，此属亦曾采自二叠纪至白垩纪的地层中。关于此属各家意见纷纭。至今仍有人作为台木（*Dadoxylon*）的一亚属。

当前的材料和前人报道的青岛附近的木化石(徐仁，1953，80页，图版1，图1—5，插图

1—4)颇有不同。如前所述,徐仁鉴定为 *Dadoxylon* (*Araucarioxylon*) cf. *japonicum*, 认为与岛仓原创立于日本侏罗纪和早白垩世的 *Dadoxylon* (*Araucarioxylon*) *japonicum* Shimakura (1936, 268页,图版12,图1—6, 插图1;1937, 5页, 图版1,图7—10)大致相似。不同的是,其管胞径向壁上纹孔行数较日本的略少,交叉场内小孔数目较多,且呈圆形。无论二者之间的关系如何,与当前标本都可以其射线细胞的形态和交叉场内具有众多小孔而进行比较,但是它们的管胞弦向壁上有时也可偶见壁孔。日本的标本管胞径向壁上,纹孔尚可多达3行,与当前标本显然不同。

如果就其管胞径向壁上纹孔排列而言,西田 (Nishida, M., 1967, 487页)描述于日本千叶县白垩系地层的 *Araucarioxylon* sp. 颇可和当前标本进行比较. 千叶县的这种木材管胞径向壁上纹孔基本上也是单行,偶而间有双行排列的,但射线较低,交叉场内仅具壁孔3个,且在管胞的弦向壁上亦有纹孔。这些特征均与当前标本完全不同。千叶县的这一化石当时经西田 (Nishida, 1967) 与 *Araucarioxylon kiiense* Ogura 进行比较。这个种是 Ogura (1944, 345页,图版3, 图A—C, I—J) 创立于日本和歌山的上白垩统,其管胞壁上的纹孔和当前标本一样,也局限于径向壁上,但其排列可达3行之多,且其射线较低,交叉场内仅具小孔3个,与当前标本有很大差别。

Araucarioxylon mineense Ogura (Ogura, 1960, 501页,图1—5)管胞径向壁上纹孔通常亦为单行,有时可见双行,交互排列,秋材狭窄,可与当前标本比较,但其交叉场内仅有纹孔1—2个。

Dadoxylon (*Araucarioxylon*) *sidugawaense* Shimakura (Shimakura, 1936, 273, 页,图版12, 图7—8; 图版13, 图1—7, 插图2.)管胞径向壁上有纹孔1—2行,和当前标本或多或少地可以比较,但该种交叉场内壁孔仅见1—3个则与当前标本完全不同。

采于美国黑山白垩系的 *Araucarioxylon hoppertonae* Knowlton (1899),其管胞壁上的纹孔,也可与当前标本进行比较,但是交叉场内仅见小孔1个可与具有众多壁孔的当前标本截然不同,此种单个的小孔似有高腾 (Gothan,1907) 所称的假孔 (Pseudoporen) 之可能。

Colani (1919) 描述于印支半岛 Vinh-phuoc 的 *Araucarioxylon* sp. 其管胞径向壁上纹孔可见单至双行,和当前标本也有些许可比之处,但总的说来双行壁孔不在少数,何况 Colani 的化石因保存欠佳,交叉场的形态不甚明了,难以详作比较。

总之,当前化石形态特殊,应为一新种,依其产地订名为 *Araucarioxylon jimoense* sp. nov.。

三、特 征

当前标本的次生木质部年轮明显; 春材发育,约36细胞宽,管胞近方形,壁厚,其横截面长、宽约 30 × 32 μm; 秋材狭窄,仅2细胞宽,管胞较小,通常扁,长方形至几近方形,其横截面为 15 × 30 μm, 壁厚; 管胞壁孔仅见于径壁, 呈南洋杉式, 排列单行,仅偶见双行;无树脂道及明显的木薄壁细胞;射线仅一细胞宽,高2—25细胞;射线细胞长方形, 水平壁和弦壁光滑,各细胞跨越4个管胞,交叉场内具3—18个广椭圆形小孔。

四、地层时代

当前的化石发现于青岛附近,年轮明显,当属中生代的产物。因为青岛一带在石炭、二叠纪时正处热带(张善桢、何元良, 1985), 其树木茎干不具年轮(张善桢, 1982)。故当前的木材标本显然不属古生代而应属中生代。据青岛山东产业馆出版的小册子"青岛之化石林"(徐仁, 1953) 中曾经记载: 即墨县西北约8 km 许的马鞍山*有中生代的化石林。徐仁还报道过产于这个地区的木化石一种及其中的菌丝(徐仁,

* 即本文所指的马山。

1953)。其木材化石和岛仓 (Shimakura, 1936, 1937) 创立于日本晚侏罗世和早白垩世的 *Dadoxylon* (*Araucarioxylon*) *japonicum* 相似，名之为 *Dadoxylon* (*Araucarioxylon*) cf. japonicum Shimakura，并认为它无疑也产于中生代地层。这个种最近也为浅间 (Asama, 1982) 描述于泰国的早侏罗世地层。所以，这个种的地质时代可能是早侏罗世到早白垩世的某一个时期。当前的化石也采于即墨县马山，其产出层位很可能和徐仁采于即墨的标本的层位大致相当。根据当地的地质情况，广泛出露于即墨县城附近的地层系下白垩统青山组。当前的化石非常可能是产于青山组的。这样，将含化石地层的地质时代定为早白垩世是比较适宜的。

五、感　　谢

本文作者对青岛市博物馆及前馆长张福臻同志惠赠标本及提供资料深表感谢。薄片承南京地质古生物研究所王寿岩同志精心磨制，显微摄影又承杨景荣同志和赵士伟同志协助，作者谨致感谢。

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NOTES ON A NEW FOSSIL WOOD *ARAUCARIOXYLON JIMOENSE* FROM EARLY CRETACEOUS OF QINGDAO, SHANDONG

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Summary

The material on which the following account is based was secured from the Mt. Mashan in the Jimo District of Qingdao, Shandong by the colleagues of the Qingdao Museum, and submitted to the writers by the late Curator of the Museum, Zhang Fu-zhen. It is represented by a permineralized log, about 7 m in length and 65—75 cm in diameter, greyish yellow in color and pregnant with silicate. Prepared with ordinary grind method, it reveals fine structures that merit description.

Araucarioxylon jimoense sp. nov.

(Pls. I, II)

In our material only the wood and pith with no bark are preserved. The pith and primary wood are however insufficiently preserved and unappropriate for a close study, and thus the description given below is based on the secondary wood.

Transverse section: Due to the development of real growth rings, the secondary wood shows a well marked zonal structure in accordance with the excentric development of the wood, with each ring somewhat varying in breadth. The spring wood is about 36 cells wide, with the tracheids nearly squarish, thick-walled, and measuring about 30×32 μm across on the average, and the largest ones measuring about 40×48 μm across. The autumn wood is narrow, about 2 cells wide, with the tracheids small, narrow, thick-walled and nearly squarish to rectangular, measuring about 15×30 μm across. No resin canal and distinct xylem-parenchyma have been observed. Rays are distinct, with their horizontal walls apparently smooth and tangential wall thin. The ray-interval is possessed of 2—11, averagely 6 cells.

Radial section: In this section the radial walls of the tracheids show bordered pits of the araucarioid type, essentially uniseriate, very occasionally biseriate. The uniseriate pits are more or less bordered, contiguous and flattened, while the biseriate pits are very rare in number, and are alternate, circular and slightly flattened in appearance. All the pits are about 18 μm in size, never occupying the whole width of the tracheids, and the central pore is either circular or elliptical and slightly inclined, measuring about 4—7 μm across. No crassulate and triseriate pits have been observed in this section. The ray cells as seen in the radial sections may be 3—4 times as long as high, each cell spanning about four tracheids. The horizontal and tangential walls of the medullary rays are smooth, with 3—18 oval small pits in each field (Kreuzungsfeld), which are inclined, measuring about 3—5 μm across.

Tangential section: The medullary rays as seen in this section are numerous and rather crowded, with 204 of them per mm. They are uniseriate and as a rule 2—25 cells high (averagely 9

cells high). The ray cells are oval, measuring 20 μm high and 18 μm broad. No bordered pits have been found in the tangential walls of the tracheids.

Comparison and Discussion: The present species is characterized by its bordered pits which are araucarioid and essentially uniseriate, with no resin canal and wood parenchyma, and by the uniseriate medullary rays in which the horizontal and tangential walls of the ray cells are smooth, with 3—18 oval small pits in the cross field. This species belongs consequently to *Araucarioxylon*, a genus with a wide range of distribution. It has been recorded from both North and South Hemispheres, geographically, and from both Palaeozoic and Mesozoic geologically. In East Asia, the genus has been discovered from Permian to Cretaceous. It is interesting that the genus has been regarded as a subgenus of *Dadoxylon*. A further discussion on this problem seems to be out of the scope of the present paper, and therefore will be presented at some other opportunity.

In the vicinity of the Jimo city, not far from the present locality, fossil woods have long since been discovered, but only a piece of them has been described as *Dadoxylon* (*Arucarioxylon*) cf. *japonicum* (Hsu, 1953, p. 80. pl. 1, figs. 1—5, text-figs. 1—4). Prof. Xu (Hsu) stated that in many respects it resembles *Dadoxylon* (*Araucarioxylon*) *japonicum* proposed by Shimakura (1936, p. 268, pl. 12, figs. 1—6, text-fig. 1; 1937, p. 5, pl. 1, figs. 7—10) from the Upper Jurassic and Aptian of Japan. However, as compared with the Japanese species, the former differs in having mostly uniseriate bordered pits in the radial walls of the tracheids, and in the greater number of pits in the cross field. As to the problem of whether or not these two species bear a close relationship, they may be readily distinguished from each other by their tangential walls also with bordered pits, if occasionally with any.

In regard to the arrangement of the bordered pits in the radial walls of the tracheids, the present material recalls fairly well *Araucarioxylon* sp. described by M. Nishida (1967, p. 487) from the Cretaceous of Choshi, Chiba Prefecture, Japan. However, the latter is characterized by the lower rays, fewer (only three) pits in a cross field, and the bordered pits in tangential walls of tracheids. *Araucarioxylon* sp. was compared by Nishida (1967) with *A. kiiense* Ogura (1944, p. 345, pl. 3, figs. A—C, I—J) from the Late Cretaceous of Wakayama, Japan. The latter may be more or less compared with the present form in its bordered pits of tracheids, which are confined to the radial walls, but may be in triseriate arrangement; this Japanese species also may be distinguished from the present form by its lower rays and fewer (only 3) pits in the cross field.

From Vinh-phuoc on the Indo-China Peninsula, Colani (1919, p. 1) described an *Araucarioxylon* sp. which might remind us to a certain extent that the present species differs in the uniseriate bordered pits in the radial walls of tracheids, but there are more biseriate ones in the former. Furthermore, owing to the unsatisfactory preservation, details about the cross field in the Indo-China material remains unknown, and therefore it is impossible to make any definite conclussion regarding its possible relation to the present form.

From what has been stated above, it seems clear that up to now no known species are closely comparable to this form and for the purpose of reference, the writers have considered that it is better to erect a new species for the material: *Araucarioxylon jimoense* sp. nov., which is named from the district where the fossil was secured, in the hope that a further opportunity will be available to study the extensive fossil forest in the Jimo District in the nearest future.

Diagnosis of the present new species: Secondary wood marked with growth rings. Spring wood open, about 36 cells wide, with tracheids nearly squarish, thick-walled and about 30×32μm across. Autumn wood narrow, 2 cells wide, with tracheids small, narrow, thick-walled, nearly squarish to rectangular, and 15×30 μm across in cross section. Uniseriate bordered pits of araucarioid type present in the radial walls of tracheid, only very occasionally biseriate. No resin canal and distinct xylemparenchyma. Medullary rays one cell broad and 2—25 cells deep. Ray cells rectangular, with horizontal and tangential walls smo-

oth; each wall spanning about four tracheids, with 3—18 oval small pits in cross field.

Geological age: The presence of well marked growth rings in the fossil log from Jimo in Qingdao of Shandong reveals that the tree might have grown in those zones other than palaeotropics. Palaeogeographic and plate tectonic studies show that the fossil locality, Qingdao, lay within the Cathaysian palaeophytogeographic province of the tropic region in Palaeozoic (Zhang and He, 1985), and the Cathaysian Palaeozoic trees were devoid of growth rings (Zhang, 1980). So the development of true annual rings in the present fossil favours the assignment of its geologic age to Mesozoic rather than to Palaeozoic.

The occurrence of Mesozoic fossil forest has long since been noted in the vicinity of the city Jimo. Early in 1953, Prof. Xu (Hsu) published a wood with septate fungous hyphae of Basidiomycetes, the geologic horizon of which is unknown. It has, however, been held by Xu as Mesozoic. The wood has been described as *Dadoxylon* (*Araucarioxylon*) cf. *japonicum* and considered to be comparable with *Dadoxylon* (*Araucarioxylon*) *japonicum* from the Late Jurassic and Aptian of Japan. Recently, the species also has been recorded from the Early Jurassic of Thailand by Asama (1982, p. 53). The occurrence of the closely allied form *D.* (*A.*) cf. *japonicum* in Jimo reveals that the fossil-bearing horizon is of the Mesozoic age as pointed out by Prof. Xu (Hsu, 1953, p. 80), or even may be inferred as Early Jurassic to Aptian in age. It is highly possible that the present material was derived from the same horizon. According to a geological map of Shandong published in 1973, what exposed in the vicinity of Jimo is the Chingshan Formation of early Early Cretaceous. There are possibilities that the fossil forest of Mashan in the Jimo District of Qingdao has been discovered from the Chingshan Formation and belongs to early Early Cretaceous in age.

图 版 说 明

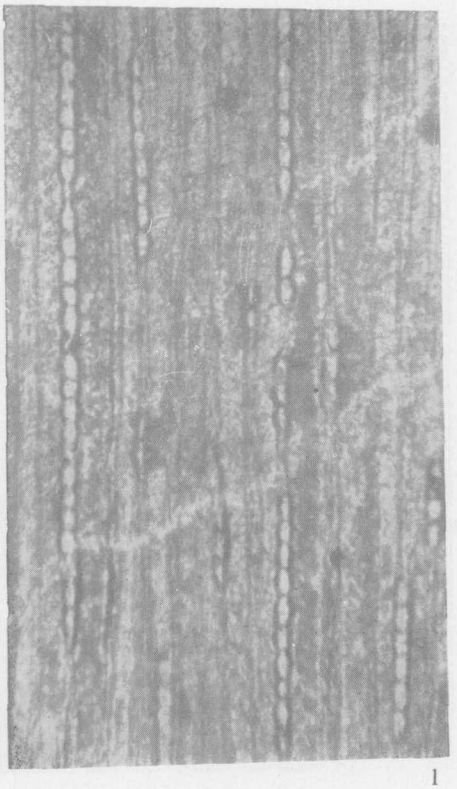
研究标本保存在中国科学院南京地质古生物所，标本采于山东青岛即墨下白垩统青山组。

图 版 I

1—2. 弦切面，示单行射线及其密度与高度。1. ×125，2. ×80。
3. 横切面，中部表示为春材，上下端为狭的秋材。×80。
4. 径切面，表示砖形的射线细胞。×80。

图 版 II

1. 径切面，示管胞在径面上的单行缘纹孔。×200。
2. 径切面，示管胞在径面上偶而具有的交互排列的双行缘纹孔。×125。
3. 径切面，示在交叉场中具有多达 18 个的众多小孔。×125。
4. 径切面，表示在交叉场中也具有 3—4 个较少的小孔。×200。



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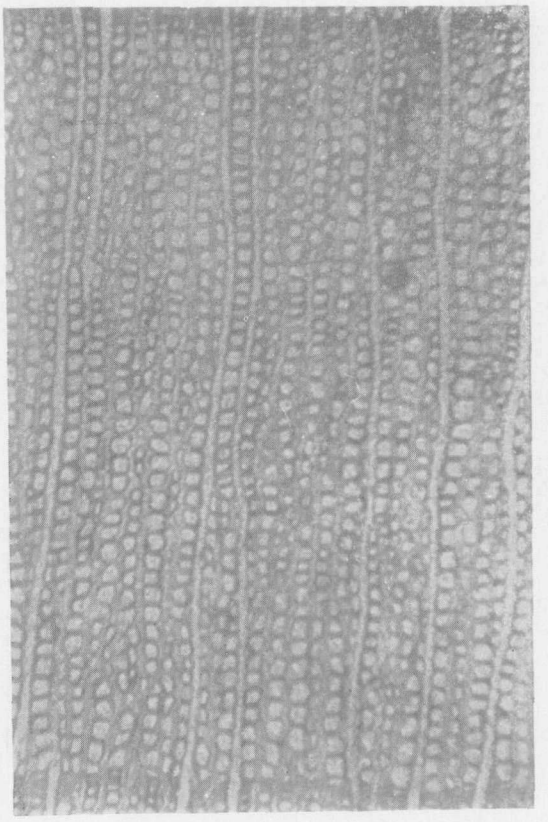

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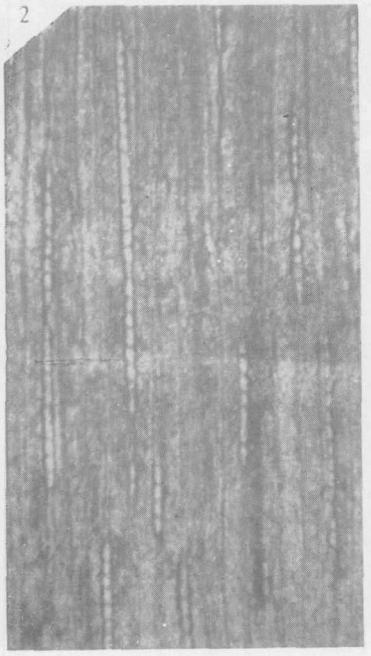

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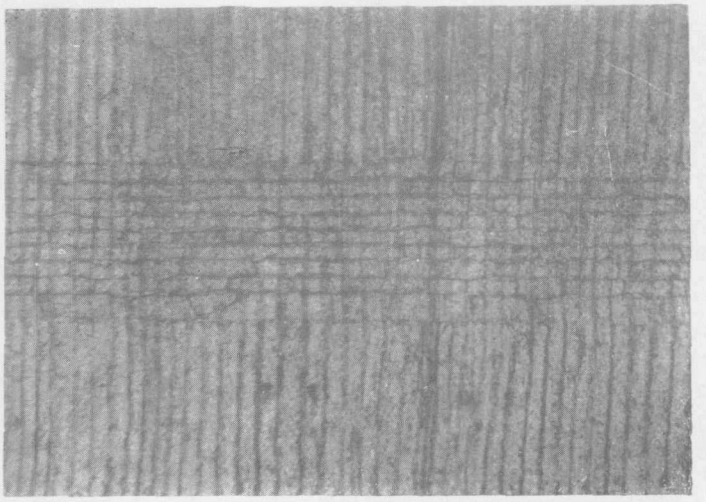

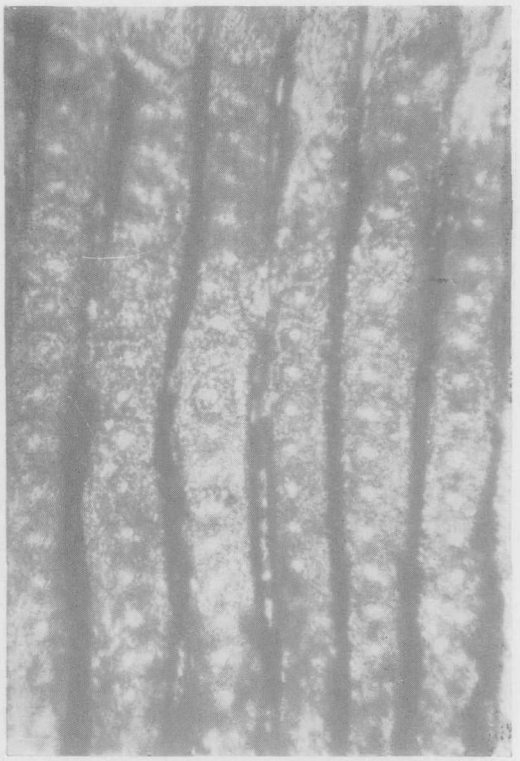

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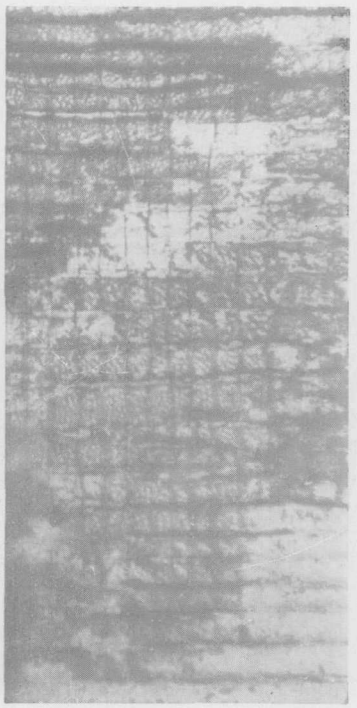

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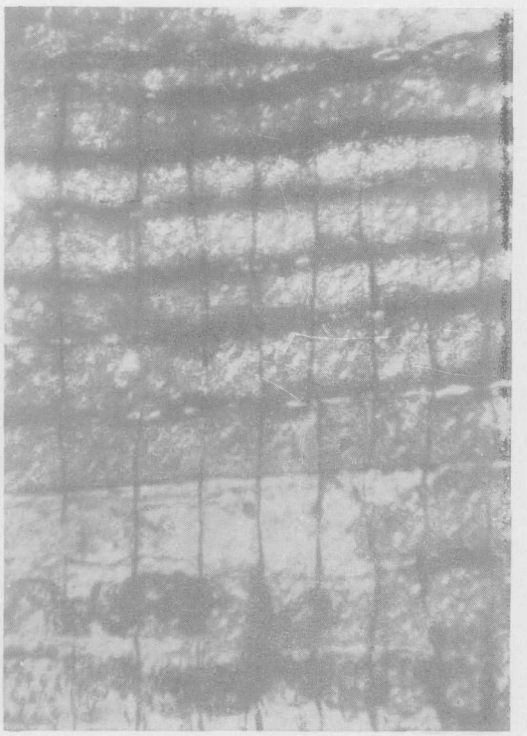

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