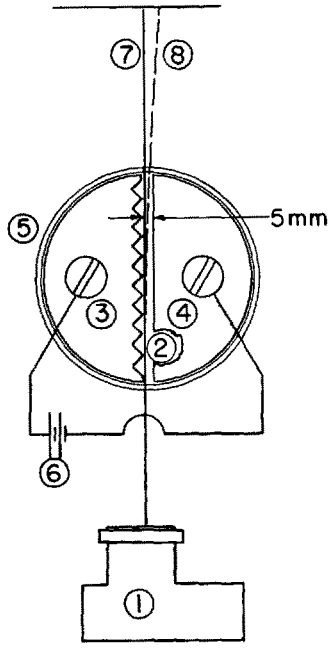
The surfaces of the faces of the electrodes which are in contact with the liquid dielectric should be corrugated for the best results. The tool of a shaper can easily make such corrugations if a course feed is used. A satisfactory spacing between ridges on the corrugated surface is one-sixteenth of an inch. Also, other spacings of one-thirty second and one-eighth of an inch between the ridges on the electrical surface have been studied and found to give the shift phenomenon. However, it has been found that a mechanically smooth electrode surface (electrically conducting glass) can also bring about a shift. The degree of shift with the smooth surface is not as pronounced for a given liquid dielectric as with a roughened surface.



Topview of Electro-optical Shift Apparatus. *1* Source of white light producing beam 1 mm in diameter; *2* liquid dielectric in space between electrodes; *3* and *4* electrodes; *5* glass container; *6* 5000 volt source ac or dc; *7* path of light beam in absence of field; *8* path of light beam with field applied.

A beam of white light 1 mm in diameter is passed through the liquid dielectric and along the face of the corrugated electrode. The path of the light is parallel to the electrode surface and perpendicular to the shaper tool marks. It should just contact the ridges of the corrugated surface as it passes along the electrode. Also, the path of the light beam is perpendicular to the direction of the electrical field. The distance of liquid traversed is approximately 4 cm. As far as is known at the present time, this distance is not critical. The strength of the electrical field used across the 5 mm spacing is of the order of 1000 volts per millimeter. The field can be either direct current or alternating current. In addition to the white light, Wratten filters of 425, 525 and 650 millimicrons were used. The light in all three cases was shifted as would be expected.

With the light beam passing along the electrode as described above, the light beam will be shifted from its original path when an electrical field is impressed across the electrodes. A shift of the light beam approximately one degree has been recorded with some liquids. The shift is always away from the electrode surface.

In the preliminary study on the electro-optical shift phenomenon, several organic liquids have been tested in the cell. Typical liquids which have been tested and found to give the shift are: ethyl acetate, absolute ethyl alcohol, absolute methyl alcohol, secondary butyl alcohol, tertiary amyl alcohol, carbon disulfide, nitrobenzene, chloroform, and p-tolyl acetate. It is important that the liquids used should be of a high degree of purity.

Studies are still too fragmentary to state conclusively the cause of this electro-optical shift, but it appears that the shift of the light beam is due to the molecular associations in the liquid dielectric concentrating and orienting in the electrical field of highest gradient thus changing the refractive index of the liquid at the electrode surface.

Research is continuing in our laboratory on the experimental and theoretical interpretation of this phenomenon.

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Department of Chemistry and Electrical Engineering, University of Cincinnati, Cincinnati 21, Ohio, September 5, 1955.

Zusammenfassung

Erzeugt man in einem flüssigen Dielektrikum, wie wasserfreiem Äthanol, Schwefelkohlenstoff, p-Tolylazetat oder Nitrobenzol, zwischen speziell gestalteten Elektroden ein elektrisches Feld von etwa 10000 V/cm, so wird ein Lichtstrahl, der die im Feld befindlichen Teile der Flüssigkeit durchsetzt, gekrümmt. Die Ablenkung des Strahls aus der geraden Richtung beträgt in manchen Fällen 1°.

Variations in the Calcification of Cementum and Dentin as Seen by the Use of Microradiographic Technique

Roentgen absorption images of small biological objects were first published by GOBY[1]. He investigated Foraminifera and introduced the name microradiography.

The publication opened new views and possibilities to investigate different tissues on histological basis. DAUVILLIER[2] took a great step forward towards a better technique by using the so-called Lippmann film with its extremely fine grained emulsion.

The method has been further improved by LAMARQUE and TURCHINI[3]. In 1936 SIEWERT[4] among other things showed the possibility of getting enlarged roentgen images working with divergent radiation.

In the nineteen forties, important investigations were made in this subject by CLARK and BOHATYRTSCHUK[5]. The latter e.g. investigated the distribution of vessels. ENGSTRÖM[6] published a quantitative method for the estimations of small amounts of different elements in biological objects in areas down to 10 μ. ENGSTRÖM, ENGFELDT, and AMPRINO[7] have published most interesting microradiograms of bone tissue showing the mineral

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[6] A. ENGSTRÖM, Acta radiol. [Suppl.] *63* (1946).

[7] R. AMPRINO and A. ENGSTRÖM, Acta anat. *15*, 1 (1952). – A. ENGSTRÖM and B. ENGFELDT, Exper. *9*, 19 (1953).

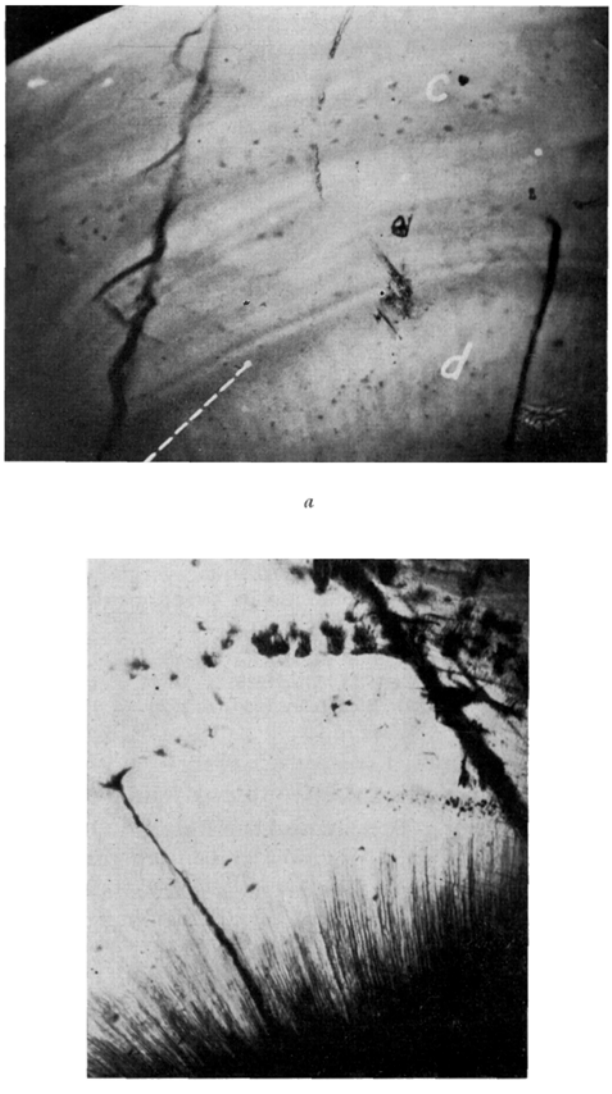

Fig. 1. 5 + ♀ aged 51. *c* = cementum, *d* = dentin. Thickness about 40 μ. *a* Microradiogram exposed 60 min at 2·5—4 Å. Notice the dark line at the arrow point (see text); (the dots in the dentin are artefacts). *b* Microphoto of the same section × 64.

distribution of the Haversian systems. ENGSTRÖM and LINDSTRÖM[8] elaborated a method for estimation of the mass of cytological material by using roentgen absorption technique. Quantitative methods have been reported by BRATTGÅRD and HYDÉN[9] too. Finally, LINDSTRÖM[10] has given a detailed report of the whole microradiographic field and of what has been done for its development.

With special applications to teeth BÖDECKER and APPLEBAUM[11] made the first microradiographic investigations. HEIWINKEL and APPLEBAUM[12] published further

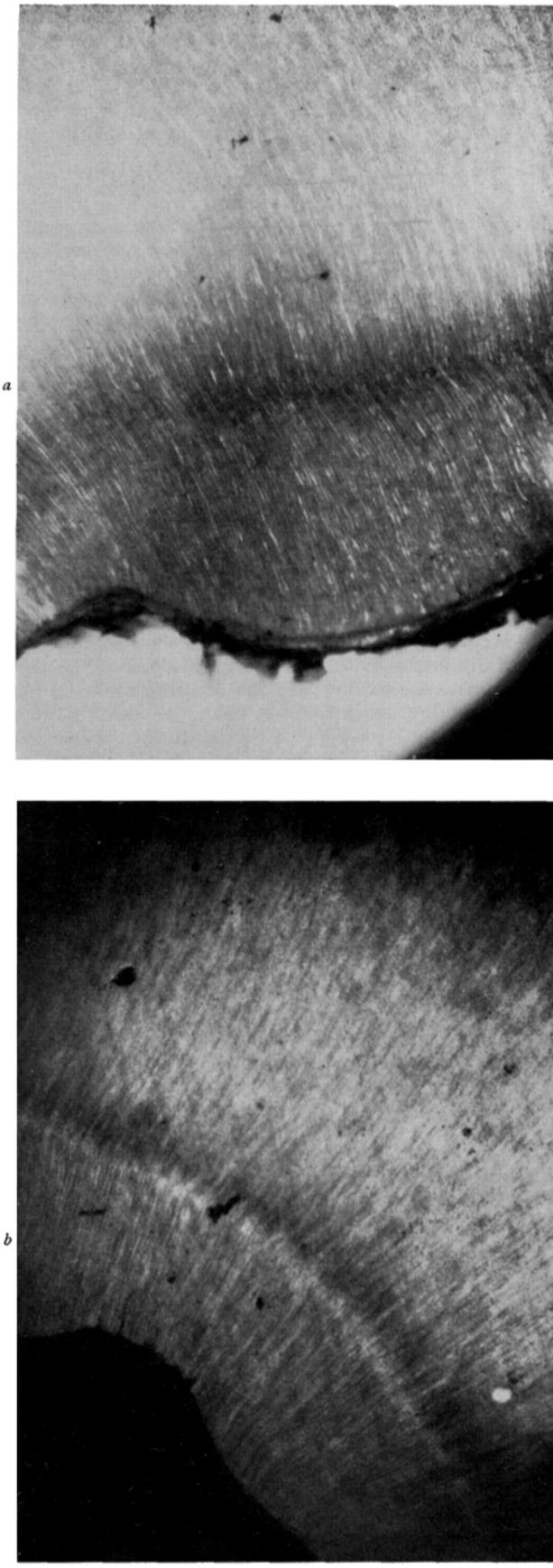

Fig. 2. + 2♀ aged 51. Thickness about 40 μ. *a* Microphoto. *b* Microradiogram of the same section exposed 60 min at 2·5—4 Å. × 64.

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[11] C. F. BÖDECKER and E. APPLEBAUM, Dental Cosmos *73*, 995 (1931).

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investigations of the same subject. However, the technique was very imperfect, but in 1933 APPLEBAUM, HOLLANDER, and BÖDECKER[13] managed to get radiograms of the minute structures of the teeth. Next year WARREN *et al.*[14] published a semi-quantitative method for estimating the relative calcium content in different parts of a tooth.

Other investigators are e.g. VAN HUYSEN, HODGE, THEWLIS, and LEFKOWITZ[15] working with the mineral distribution of intact or carious teeth. Several interesting findings have been published by these authors, e.g. the highly absorbing Mackie-line in the superficial layer of the enamel. The mineral distribution in osteogenesis imperfecta and in cases of osteopetrosis is studied by BERGMAN, ENGFELDT and HAMMARLUND-ESSLER[16].

The microradiographic technique makes it possible to correlate the calcium distribution of teeth directly to the morphological structures. This is possible by exposing ground sections of teeth (in this case 20–30 μ thick) to roentgen radiation within a narrow wave length region, here 2·5–5 Å. The absorption curve of calcium has its K-edge at 3·07 Å. A Machlet type AEG 50 tube (1 mm Be filter) has been used[17].

Some parts of the dentin and the cementum contain great amounts of organic components, e.g. the dentinal tubules and the cementocytes. Consequently in the radiograms these parts appear as black areas in contrast to their surroundings. However, the more calcified areas show a distinct variation in the mineralisation. In the radiograms close to the pulp the dentin often shows a zone containing more calcium than the surroundings (Fig. 2*b*). In the periphery of the dentin at the dentin-cementum junction, a hypocalcified zone appears practically constant (Fig. 1*a*). In decalcified sections stained with Sudan B LORBER[18] has published a similiar picture with a dark zone at the same place containing a concentration of lipids.

A more inconstant appearance but by no means unusual is the presence of bands in the cementum due to rhythmical mineralisation. The microradiograms show that the cementocytes are sometimes situated between the bands. These are present mostly in teeth with branching roots and they appear most distinctly in cross sections from the bifurcation of the root. In this case the absorption of the light bands is 1·5–2 times bigger than that of the darkest band. (The absorption is registered by a microphotometer constructed by BOURGHARDT, BRATTGÅRD, HYDÉN, JIEWERTZ, and LARSSON[19].)

It is evident that in the cementum a rhythmical mineralisation is present although its appearance here is a little more difficult to show. The bands might originate because of nutritional factors, e.g. illness, starvation and so on, like the transverse lines of childrens' long bones described by ASADA, ELIOT *et al.*[20]. In both cases (see Figures texts) the enamel shows no Hunter-Schreger bands and only a few lines of Retzius. However, the latter appear very distinctly.

H. RÖCKERT

Histological Institute, University of Gothenbury, September 1, 1955.

Zusammenfassung

Nach einer Übersicht über die Literatur werden die folgenden Befunde angeführt:

1. Eine hyperkalzifizierte Zone im Dentin nahe der Pulpa.
2. Eine hypokalzifizierte Zone an der Grenze zwischen Dentin und Zement.
3. Banden im Zement, verursacht durch rhythmische Mineralisation.

Mikroradiogramme und Mikrophotographien derselben Zahnschnitte werden miteinander verglichen und so die zytochemischen Befunde in Zusammenhang gebracht mit dem zytologischen Bild.

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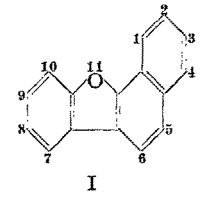
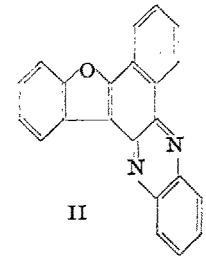
A Synthesis of α-Brazan and the Related Quinone

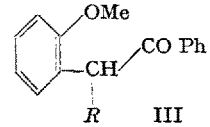
KRUBER and OBERKOBUSCH[1] have isolated α-brazan[2] (I, m. p. 103–104°) from coal tar distillation products. On oxidation with chromic acid, this compound gave, along with other products, α-brazanquinone which was isolated as the quinoxalin derivative (II, m.p. 252–253°). A simple synthesis of both these compounds is now reported.



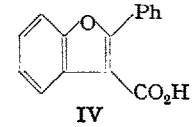
I



II



III



IV

The keto-nitrile (III, R = CN, m.p. 88–89°) obtained by the condensation of ethyl benzoate with *o*-methoxyphenylacetonitrile[3] gave the related ester (III, R = COOEt, m.p. 71–72°) on treatment with alcoholic hydro-

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