CARL ZEISS
JENA

Polarizing Microscope LABOVAL® pol



Today, more and more branches of science and industry come to employ polarization microscopy as a means for research, routine work and inspection.
Our MIKROVAL range of microscopes includes two smaller polarizing microscopes, which have been developed primarily for the purpose of introducing microscopists into the multifarious techniques of polarization microscopy and training students of geology and mining sciences but are also applicable to industrial routine and control measurements as well as for solving particular research tasks.
The LABOVAL pol · d is intended for transmitted-light observation in bright field and phase contrast, whereas the LABOVAL pol · u is equipped for bright-field incident-light work as well.

Both models are distinguished by their sturdy stands and simple operation. They permit polarizationoptical exactitude of observation and accuracy of measurement with the simpler test methods.

Since the LABOVAL pol Polarizing Microscopes are integrated within the modular MIKROVAL system, a vast range of accessories is available to extend their applications.

Polarizing Microscope
LABOVAL® pol · d

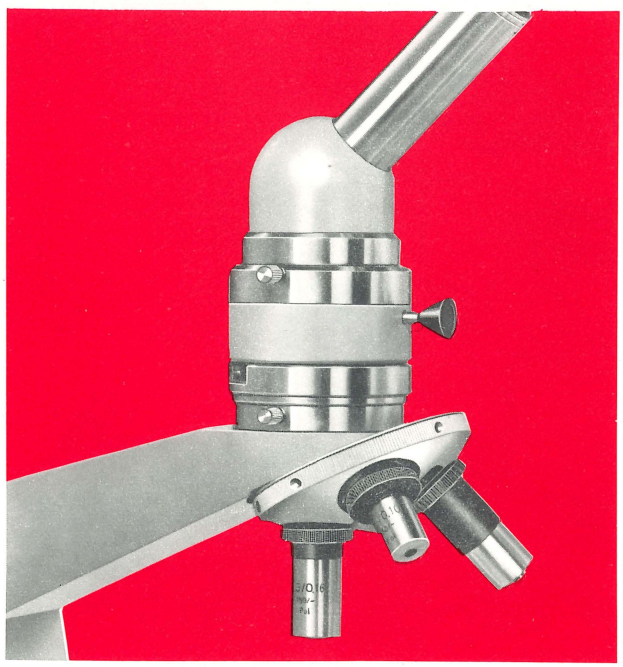
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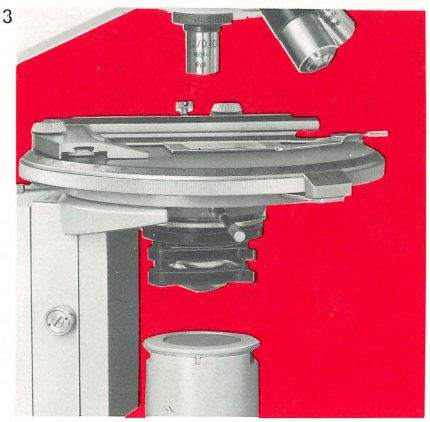
Prominent merits of the LABOVAL pol Polarizing Microscopes:

- Low-positioned single-knob control for coarse and fine stage adjustment
- Large factory-centred revolving stage with graduation and two verniers
- Attachable graduated object traverser, 22 × 44 mm, no restriction of nosepiece revolution
- Revolving nosepiece with three individually centred objective fixtures
- Intermediate tube pol with telecentric ray path, interchangeable with incident-light equipment
- Permanently oriented swing-out filter analyzer
- Polarizing condenser with rotating polarizer and hinged wide-field lens, interchangeable with phase contrast condenser
- Filter polarizers of high extinction and largely neutral transmission
- Compensators for qualitative and quantitative studies
- Strain-free Achromat pol objectives for transmitted and incident-light work
- Adjustable eyepieces, with cross-hairs aligned with the vibration directions of the polarizers
- Low-voltage lamp for transmitted light, interchangeable with a mirror

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The **intermediate tube pol** (Fig. 2) is the significant optical component of the LABOVAL pol polarizing microscopes. It contains the swing-out filter analyzer arranged between two Telez lenses in a telecentric ray path. Closely below the analyzer there is an opening in the tube which accepts compensators. The intermediate tube pol also contains a Bertrand lens for indirect observation, which is matched to the 40/0.65 achromat to such an extent that a well-defined interference pattern becomes visible immediately after the Bertrand lens has been inserted. An adjusting screw is provided for keeping the analyzer in correct alignment with the polarizer.

The LABOVAL pol Polarizing Microscopes employ achromatically corrected objectives in strain-free mounts. The following types are provided:

Semi-plane
Achromat 3.2/0.10 160/— pol
Semi-plane
Achromat 6.3/0.16 160/— pol
Achromat 10/0.25 160/— pol
Achromat 40/0.65 160/0.17 pol

The objectives of type 160/— are suitable for both transmitted and incident light, whereas the 160/0.17 one is designed for transmitted light only. The objectives are parfocalized. With A 6.3× and A 16× eyepieces, the magnification range covered is 20 to 640× for transmitted light and 40 to 320× for incident light.

The **revolving stage** (Fig. 3) permanently centred at the factory has a scale which reads to 0.1°.
The stage is provided with holes for stage clips and the attachable object traverser. The object traverser has a range of movement of 22 mm × 44 mm. It accommodates slides of 28 mm × 48 mm and 26 mm × 76 mm.
The polarizing condenser has a maximum N. A. of 1.2. It is provided with an adjustable aperture stop and a hinged large-field lens. The polarizer may be rotated through more than 180°; its zero position being fixed by a click stop.

The standard LABOVAL pol equipment includes λ and λ/4 **compensators** as well as a λ/2 . . . 3 λ wedge-compensator. A 0 . . . 6 λ measuring compensator with quartz combination plate after EHRINGHAUS is provided for measuring path differences on transparent birefringent objects. A table supplied with the compensator lists the path difference for direct reading without computation.
A λ-compensator in sub-parallel position serves for high-contrast representation of slightly anisotropic objects, particularly under incident light conditions.

Brass Ms 63, electrolytically polished incident light — bright field, crossed polarizers, M = 240 : 1

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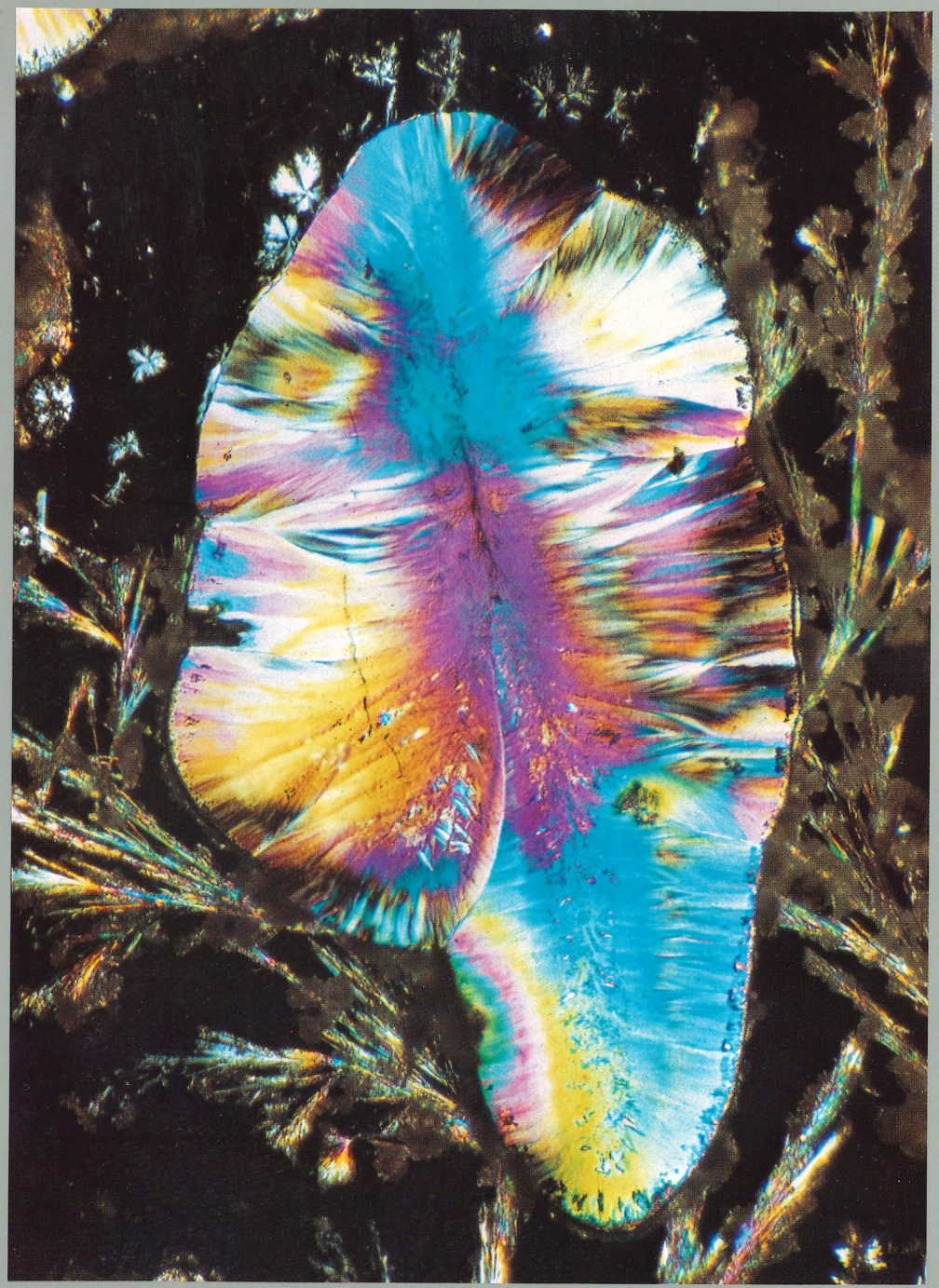


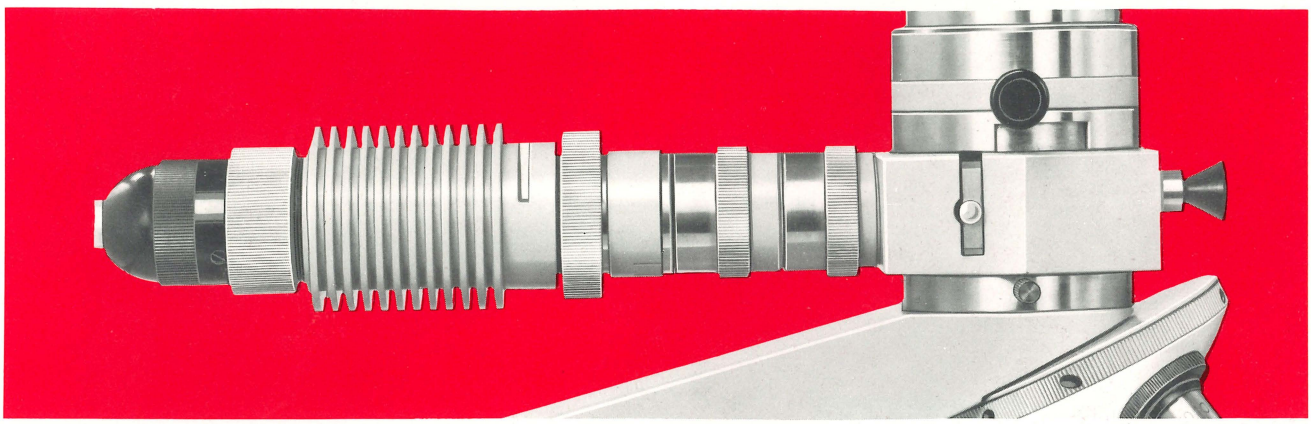
Polarizing Microscope
LABOVAL® pol · u



Karlsbad salt
transmitted light — bright field, crossed polarizers, M = 320 : 1

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Where absorbing substances in the form of ground and polished sections are to be examined, the intermediate tube **pol** of the LABOVAL pol·u can be replaced by an incident-light equipment (Fig. 8). The equipment is arranged in accordance with the KÖHLER illumination principle, containing adjustable diaphragms which limit the luminous field and the illumination aperture. The source is a 6-volt, 15-watt flat-core projection lamp; the equipment is, however, versatile enough to allow microscope illuminators of higher intensity to be used, e.g., for photomicrography.

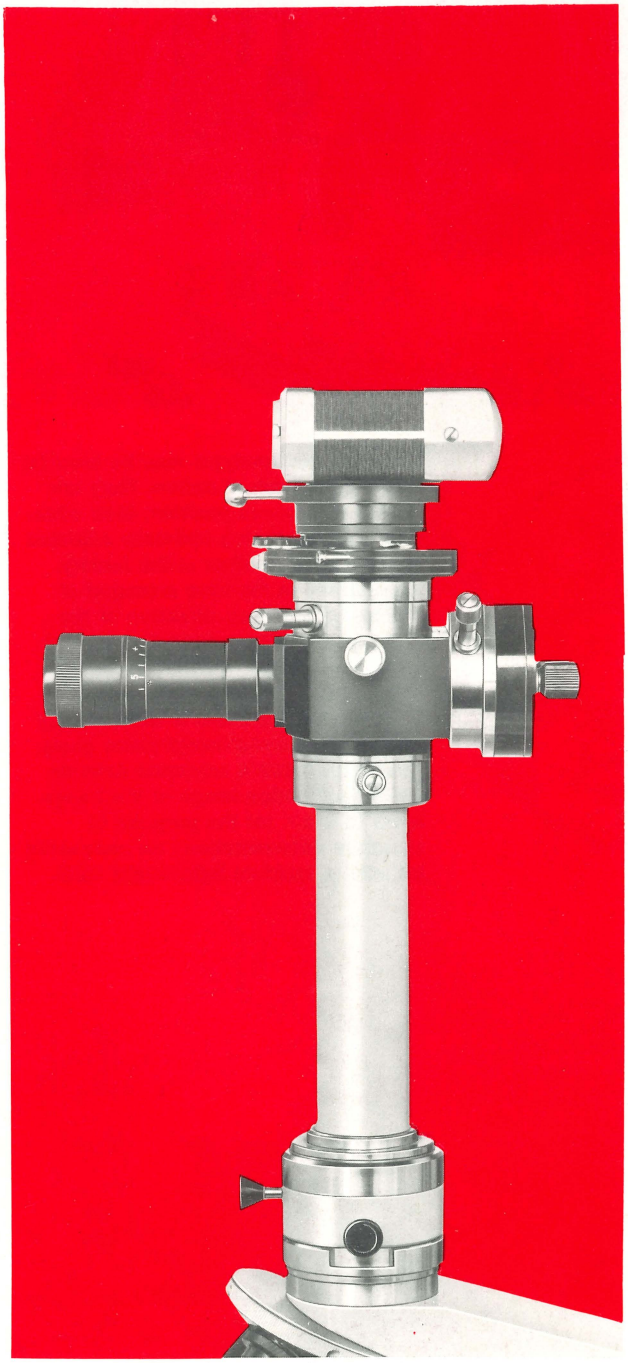
Polarizer and analyzer may be brought into the ray path at option. They are always in crossed position, their vibration direction being optimally adjusted relative to each other at the factory. An opening in the tube arranged at 45° to the vibration direction of the analyzer accepts polarization-optical compensators for qualitative determinations.
The illumination beam is deflected by means of a semi-silvered plane glass. The 40/0.65 160/0 achromat extends the magnification range of the equipment to 640× for the purpose of structure determinations on uncovered objects in incident light-bright field.

For the quick, easy and convenient photographic recording of the images observed in the LABOVAL pol, an attachment camera can be assembled from modular components of our **mf Photomicrographic Equipment**

Mechanically, the camera is adapted to the microscope by means of an tube. Optical adaptation is effected by means of 4:1 and 6.3:1 **mf** projectives which are inserted into the tube. The 4:1 measuring projective projects a measuring scale onto the photograph. In the case of polarizing microscopes, the attachment camera should employ the **mf · pol** basic body, the components of which do not interfere with the polarization-optical conditions. The basic body has a focussing system which shows a large extra field surrounding the image area covered by the camera. A built-in photocell permits to measure exposure times.

An **mf** basic body for the automatic exposure device is also available.

Both basic bodies preferably accept camera bodies for 24 mm × 36 mm or 6.5 cm × 9 cm film material.



In order to have a controlled illumination of high light intensity for the microscopic specimen the microscope lamp 6/15 (Fig. 11) is plugged into the base of the LABOVAL pol microscope and clamped in position. A lamp holder for 6 V 15 W projection lamp with flat-core filament, which can be clamped, centered and focused, a built-in iris diaphragm with collector, and an adjustable deflection mirror allow the KÖHLER principle of illumination to be correctly carried out. The lamp housing is provided with a slit to accept light filters of 32 mm ϕ. Mains connection is via a transformer.

Cordierite gneiss from Lunzenau/Saxony, thin section transmitted light – bright field, 1 polarizer, M = 50 : 1

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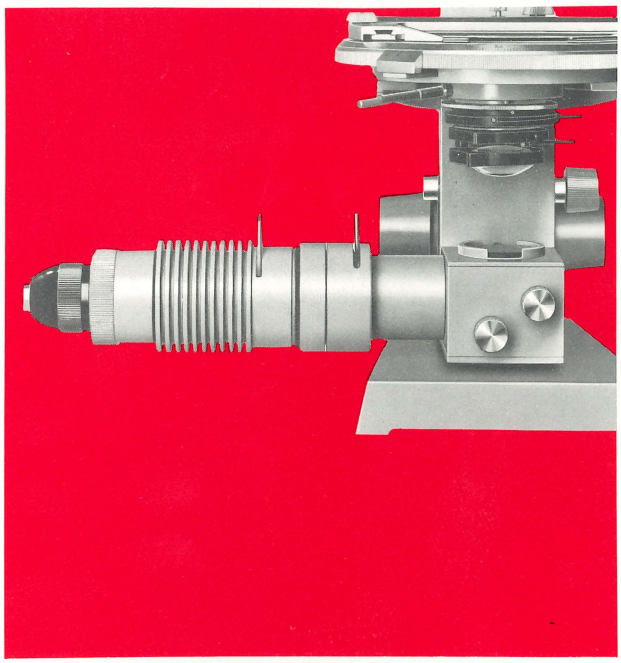
In tuition and training lessons, the drawing of the outlines of microscopic pictures is still of quite some importance in our days. We have seen fit therefore to design for our microscopes a moderately priced **drawing eyepiece** (Fig. 12) of easy manipulation. It is intended for tubes of 45° direction of observation and is fitted with all the merits of the ABBE drawing apparatus. The outfit consists of an 8× eyepiece and a beam-splitting cube. The drawing surface and the microscopic image can be seen critically depicted at the same time. The intensity of both the microscopic image and the drawing surface may be adapted to each other by means of light-regulating filters.

Measurement of lenghts and areas may be carried out with the aid of the **measuring eyepiece** (Fig. 13) A 10× or 12.5× or of the eyepiece screw micrometer K 15×. The measuring eyepiece A 10× (field No. 14) and A 12.5× (field No. 16) are arranged in such a manner that in their object plane measuring disks of different graduations may be optionally inserted. For routine measurements, the eyepiece measuring disk 10:100 with 0.1 mm reading is recommended. When using the eyepiece screw micrometer K 15× (field No. 10.5) the reading accuracy is increased by the factor 10×.

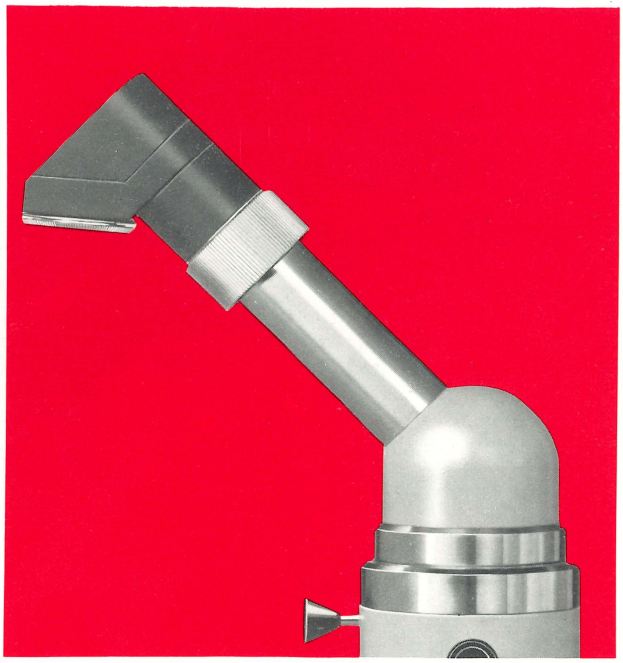
In cases where objects differ from their surroundings only by thickness or refractive index, the phase-contrast method must be employed to produce sufficiently sharp contrast. It can therefore be successfully employed in determining the refractive index of mineral grains.
The **phase contrast equipment** (Fig. 14) for the LABOVAL pol·d consists of an aplanatic condenser and the Phv Achromats 6.3/0.16, 16/0.32, 40/0.65 and HI 100/1.25. In addition to the application of the normal phase-contrast method, it still allows of carrying out the so-called "strict" phase-contrast method, which is more advantageous in measuring light-refraction.



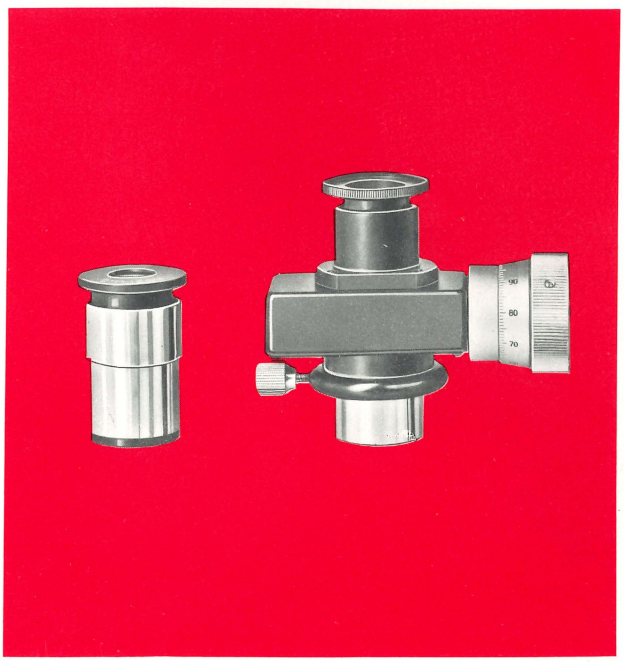
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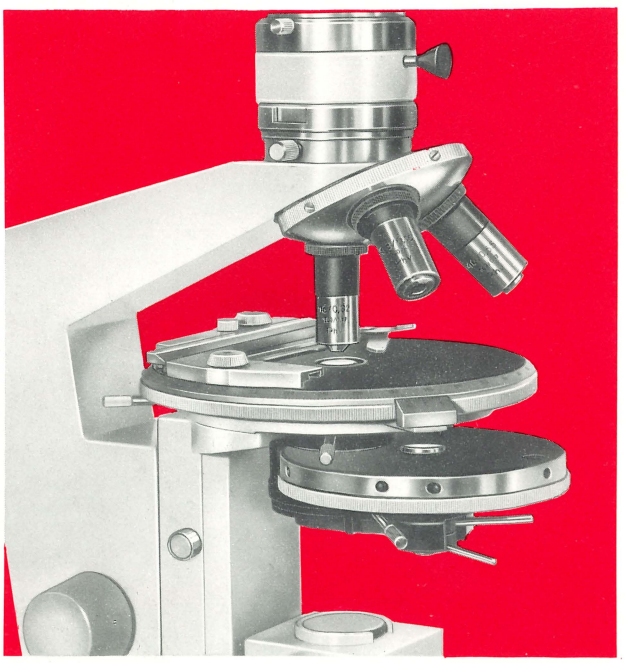
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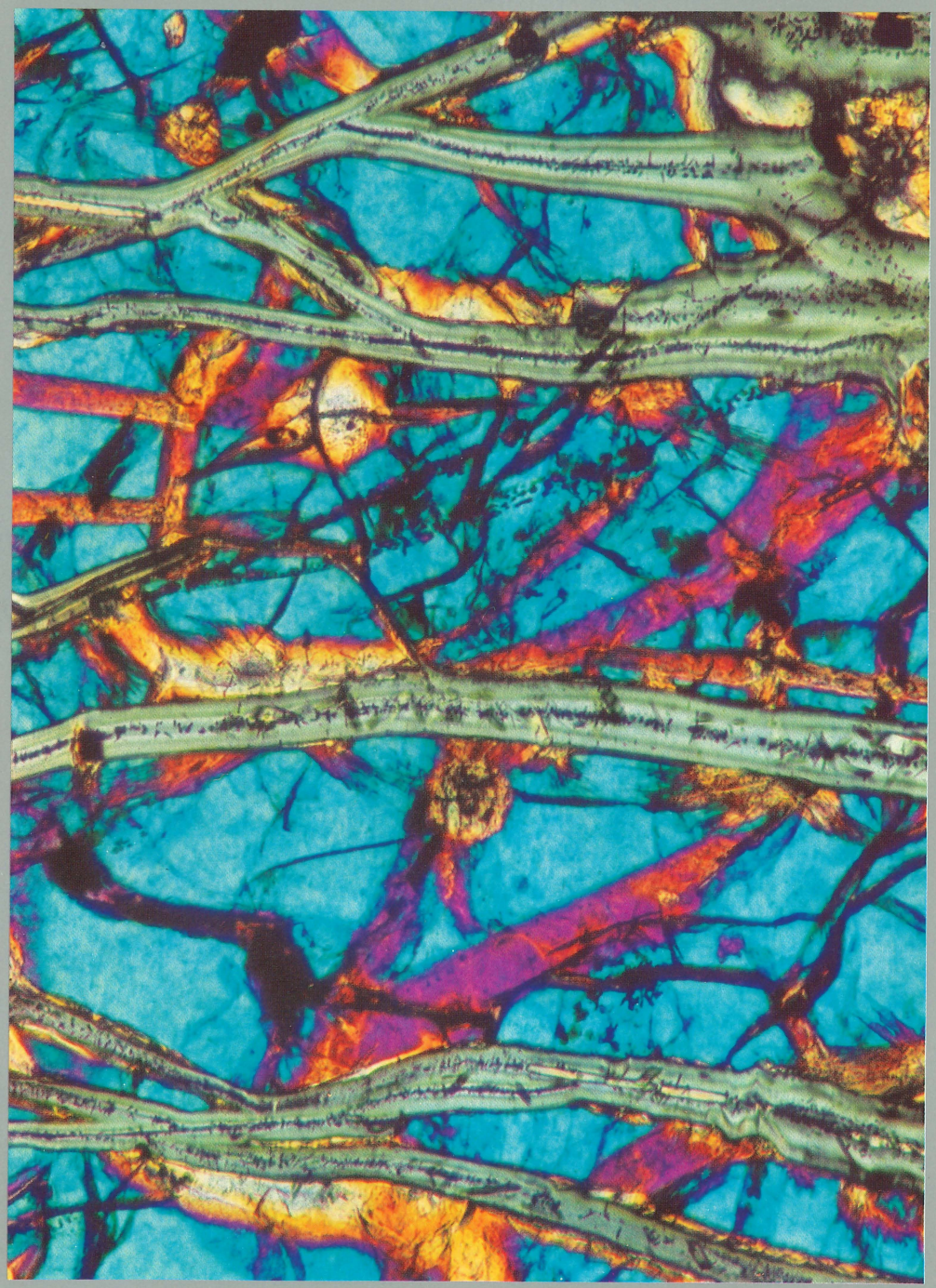


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Picrite from Schleiz, thin section, transmitted light — bright field, crossed polarizers, M = 200 : 1

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