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A simple cost-effective infra-red microscope for palynology

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It has long been known that objects which are opaque in transmitted white light can become translucent in infra-red (IR) light. Its application to palynology was shown by Leclercq (1933) who used an IR filter to cut out the visible light from the specimen coupled with an IR-sensitive film to capture the image. Although the significance of this development was recognized (Walton, 1935), it was never generally used since oxidative methods such as Schulze's solution are normally successful in clearing exines. The exceptions are opaque palynomorphs from thermally over-mature rocks. Such assemblages have been studied with IR microscopy using either IR-sensitive film on partially cleared material (e.g. Tiwari & Schaarschmidt, 1975) or electronic IR imaging systems (Cramer & Diez, 1972).

The technical sophistication and performance of IR imaging microscopes has recently improved significantly following their routine application for the internal imaging of silicon chips. However, such microscopes are designed for use in reflected light and also rather costly. In addition their design makes them difficult to routinely switch from brightfield transmitted light to IR light without risk of damaging their sensitive IR tube. This note describes a simplified IR microscope for transmitted light which shows how excellent images of opaque spores in the near-IR can be produced using the simplest palynological microscope.

This IR microscope is based around an Olympus BHSM-IR system. This is fitted with a 100W quartz halogen bulb which is essential for providing the required level of IR illumination. However, the only specific IR corrected optics this microscope utilizes are in the stand and condenser. These are quite similar to normal components but lack the coatings specifically designed to suppress the transmission of IR light. Instead of using specially corrected IR objectives, achromats are used as these contain both the fewest optical components and lack the sophisticated optical coatings which reduce IR transmission. In addition, rather than a sophisticated IR tube, a normal monochrome video camera (Sony XC-77CE) is used which has had its IR short pass barrier filter removed. This provides enough sensitivity in the near-IR to produce a good quality image on a standard monitor. This camera output is also linked to a high resolution Lucius & Baer monitor with photographic system for quality image production and a video printer. The operation of the microscope is simple with switching from brightfield transmitted light to the near-IR being achieved by placing an IR long pass filter (e.g. 0.9 μm) in the field aperture filter holder and increasing the illumination until a satisfactory image is acquired on the monitor. Minor refocusing is required to correct for the longer wavelength of IR light. The image produced maintains its quality to the magnification of a $\times$100 objective. Although this particular microscope is based around an IR stand, a cheaper system would use a normal stand and simplest optics, the only additional equipment required being a monochrome video camera, monitor and IR filter.

Results from using this system are shown in Figs 1a–c. The quality of these images is still excellent at high magnification (Fig. 1c). Although successful with most opaque palynomorphs it is unable to produce images from highest thermal maturity level material. However, it proves successful in these instances by using either partially oxidized material and thus avoiding re-darkening of the palynomorphs as a consequence of agressive oxidation (e.g., Marshall, 1980) or imaging these re-darkened palynomorphs following oxidation. It is also very useful for imaging the thicker-walled elements in an assemblage (such as megaspores and chitinozoans) where oxidation sufficient to render these components translucent would destroy the other palynomorphs.

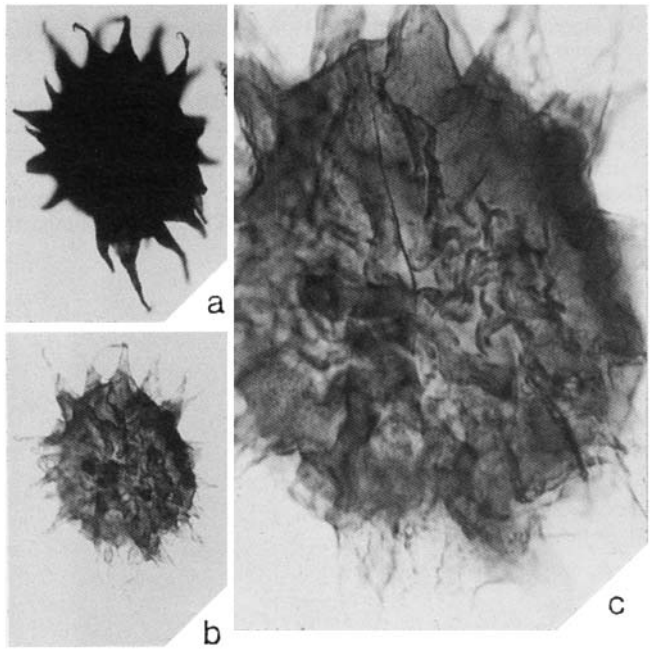

Fig. 1. Specimen of *Ancyrospora longispinosa*: (**a**) photographed in transmitted white light from a high resolution monitor image ($\times$140); (**b**) photographed in IR light using a 0.9 μm IR long pass filter (note the internal and surface detail of the specimen can now be clearly seen); (**c**) at a magnification of $\times$400 – the image still retains its quality at this and higher magnifications.

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