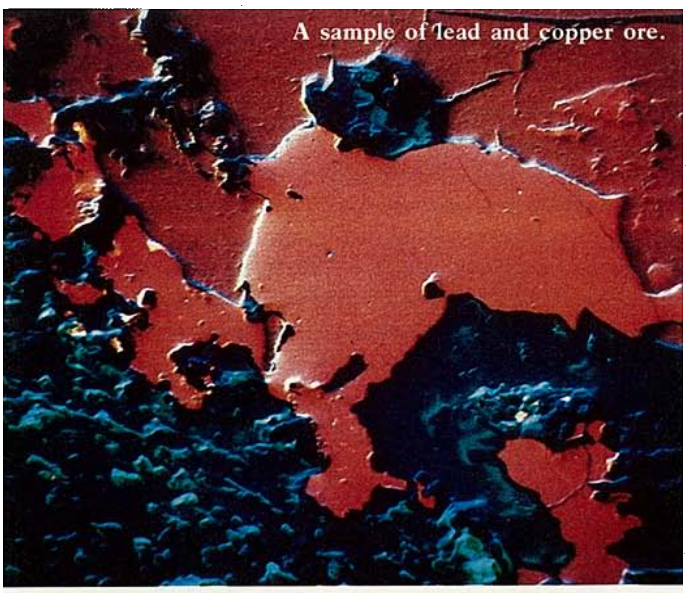

A sample of lead and copper ore.

A powder post beetle (*Lyctus brunneus*).

Zeolite mineral.

Colour photos from the electron microscope

A film or television program screened in colour appeals to us more than one in black and white. Apart from the obvious aesthetic appeal, greater detail, clarity, and subtlety are possible.

In examining our environment in its minutest detail, scientists involved in the use of electron microscopy have been working towards getting a colour image from their instruments. One such scientist is CSIRO's Mr Ari Antonovsky of the Conservation and Biodegradation Section at the Highett site of the Division of Chemical Technology.

The image on the screen of a scanning electron microscope (SEM) differs fundamentally from the familiar coloured video and photographic images. In the SEM, the wavelength of the electrons used to form the image bears no relation to the wavelengths of visible light (and therefore colour).

Two earlier methods of introducing colour into SEM images have met with moderate success. In the first system, various intensities of grey are assigned different hues; and the second is a colour-mapping process in which colours are assigned according to electronic level or atomic number.

However, these methods fall short of producing normal tonings. So, with some clever lateral thinking, and some advice on colour photography techniques from Mr Peter Lee of the Division of Building Research, Mr Antonovsky developed an easily applied method that gives a quick,

clear image with colouration appropriate to the article examined.

The SEM colour picture is built up in the same way as the image on a colour television set. Red, green, and blue combine to form one full-colour picture. Adjustment of their relative intensities produces natural tones.

But how is this possible if electron illumination can never reproduce visible colour?

Mr Antonovsky devised a scheme where electrons were collected in three different ways, within the SEM, to give three different images. The image formed by backscattered electrons was assigned a red colour (the best contrast is provided this way); the image created by secondary electrons was given a green colour, and a third (blue) image was obtained by capturing only the high-energy secondary electrons.

The red image illustrates differences in atomic number within the sample, which may be brought about by a stain or a metal coating applied to biological specimens. The other two images depend more on the three-dimensional structure of the sample.

By overlaying the three distinct SEM images produced in this fashion, Mr Antonovsky can build up high-definition colour images on colour film directly from the electron microscope. Each primary-coloured image can be retrieved from the three-part composite by use of colour filters to cut out the two unwanted images.

Just as colour photography has enriched our lives with images close to the real thing, so now scientific understanding of the minutest specimen may be facilitated by the use of colour.