

MICROSPOTS ON IIIa-J PLATES ("GOLD SPOT DISEASE")

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The UK 1.2 metre Schmidt Telescope at Siding Spring Observatory, Australia, has taken about 8500 plates since it was commissioned in 1973. A large fraction of these plates, including those for the southern and equatorial Sky Surveys, are on Eastman Kodak IIIa-J emulsion. A significant number of these processed IIIa-J plates have developed many small gold spots similar in size to faint star images. They are most likely to occur in areas of relatively high density, such as in bright star images or on the stepwedges, and are sometimes scattered around in non-image areas (fig. 1). An alarmingly high proportion of plates taken in 1974-75 (about 50 per cent) have developed gold spots, and the most recent affected plate found so far is J6517, taken in October 1980. Four early IIIa-F plates have also been found to have gold spots. The degree to which plates are affected may be slight, with spots appearing only on one or both stepwedges; moderate, with spots appearing along one, two, or three edges of the plates; or severe, when spots appear all round the edges or all over the plate. The affected plates are divided approximately equally between these three categories. It seems that the spots take about 3 years to develop, after the plate has been exposed and processed. This makes it very difficult to establish possible causes of the problem, which is almost certainly not curable. Unfortunately, gold spot formation involves changes in the structure of image silver and some silver migration. Even if it were possible to remove the gold spots, this could only be cosmetic since there is no way to restore the original structure of the image silver. It is therefore extremely important to find the causes of these spots as soon as possible, so that their occurrence on any more plates can be prevented.

The causes of microspot formation have still not been convincingly established, but the list of primary suspects include pick-up of contaminants in processing solutions, hydrogen peroxide fumes and fumes from fresh oil-based paints (1, 2). IIIa emulsions, unlike most others, are based on pure silver bromide, and there is some evidence to suggest that gold spots may be formed if the IIIa-J

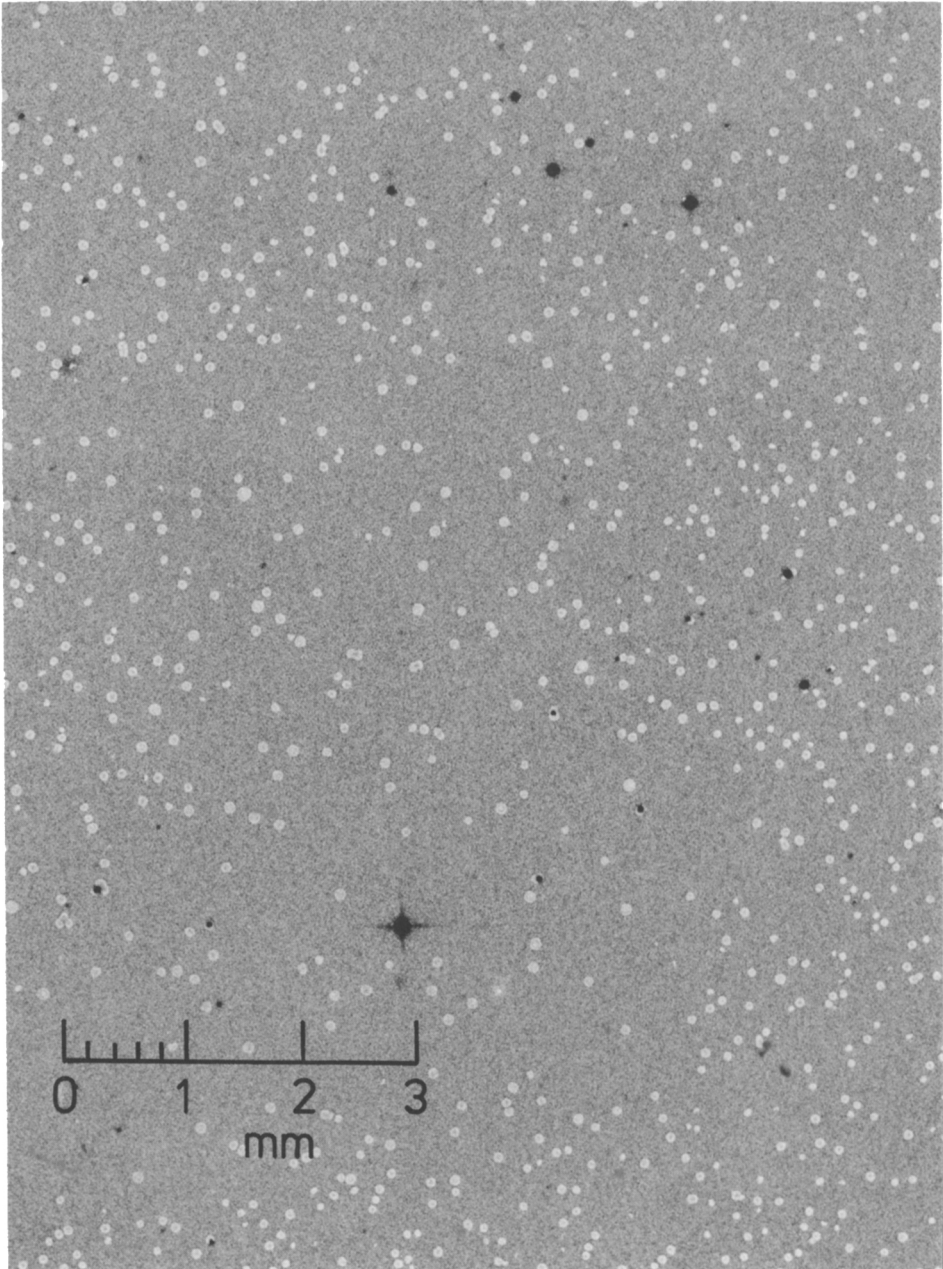


Figure 1. Microspots, which appear white in this print, may form around existing images or at random in the field.

picks up iodides or chlorides left in the processing solutions by other types of emulsion. To minimise this risk, the processing system at Siding Spring has been modified, along the lines of recent Kodak recommendations, to provide a separate, dedicated processing line for IIIa-J and IIIa-F plates so that they cannot pick up contaminants deposited into the solutions by other emulsions.

The soft foam packing that was used to protect plates during shipping is a potential source of hydrogen peroxide. Users are therefore asked to discard all such foam packing. Polystyrene sheets provide sufficient protection for the plates without any harmful chemical effects. Plates should never be stored in or near areas which have recently been painted, to avoid the risk of spot formation from contamination of paint fumes.

Investigations continue at ROE, Siding Spring, and Eastman Kodak into the occurrence and possible causes of gold spots on IIIa-J plates, and ways of preventing them. UKSTU has probably the largest, most homogeneous and well-documented collection of IIIa-J plates in the world. Andy Good in Edinburgh and John Dawe in Australia are systematically searching and monitoring all the available IIIa-J plates for signs of gold spots. So far 327 affected plates have been found, out of 1715 inspected. This includes accepted Sky Survey plates, about 40 of which are affected.

To protect plates from spot formation, Eastman Kodak have recommended treating plates for 3 minutes in a 1+19 solution of Rapid Selenium toner. This deposits a thin protective coat of selenium over the image silver. Further investigations of possible adverse effects of toning will be made before it is included in our processing system. If the affects of toning are acceptable, it may then be possible to treat unaffected and slightly affected plates to inhibit spot formation.

REFERENCES

1. Millikan, P.G., Miller, W.J., and Black, D.L. "Astronomical Photography 81", ed. Heudier & Sim, p. 153, 1981.
2. Feldman, L.H., *Jnl Applied Photographic Engineering* 7, 1, 1982.