COLOUR MARKINGS IN *PHACOPS* AND *GREENOPS* FROM THE DEVONIAN OF NEW YORK

by GEORGE C. ESKER, III

ABSTRACT. The colour markings in *Phacops rana* and *Greenops boothi* are described and discussed. It is suggested that *P. rana* had the ability to change its pigmentation. Only four examples of colour markings in trilobites have been mentioned in the literature.

THREE specimens of more or less complete dorsal exoskeletons of trilobites with colour markings have been discovered in the Middle Devonian Hamilton shale at a locality near Alden, New York. Two of these specimens are identified as *Phacops rana* Green 1832, and the third as *Greenops boothi* (Green 1837). The specimens exhibit colour markings in the form of black spots wherever the dorsal exoskeleton is intact and unweathered. The black spots are presumed to be original rather than diagenetic because of their linear arrangement on the pleura and not on the axis and glabella of the specimen of *G. boothi*. The irregularly circular black spots vary in size, are randomly arranged in *P. rana*, and have a linear arrangement in part in *G. boothi*. The black spots are probably melanophores.

The two specimens of *P. rana* have the black spots scattered over the entire exoskeleton. This general pattern appears to be the same as that described by Teichert (1944) as occurring in a pygidium of *Ditomopyge meridionalis* from the Permian of Australia. One of the two specimens of *P. rana* has spots noticeably smaller in size than in the other specimen. Many of the spots are very irregular and show black branches extending out from them. The specimen with larger spots has very short black branches extending outwards. It is assumed that these two specimens belonged to the same species possessing the ability to change its pigmentation, rather than that they show different degrees of fixed pigmentation. This suggests that the specimen with the smaller spots had the pigment contracted into the central area and the main branches. This would make the whole surface of this trilobite lighter to match its background. The specimen with the larger spots has the pigment expanded to occupy nearly all the branches of the melanophores; this individual would therefore be darker to match a darker background. Such an ability to change colour to match its background would

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Figs. 1, 3–5. *Phacops rana* Green. 1, Dorsal view of complete specimen, ×3, Louisiana State University Geology Museum, Type Collection No. 8269. 3, Lateral view of enrolled specimen, ×4, Louisiana State University Geology Museum, Type Collection No. 8271. 4, Portion of left thoracid pleura, ×165, same specimen as 1, contracted pigment. 5, Portion of left pygidial pleura, ×165, same specimen as 3, expanded pigment.

Fig. 2. *Greenops boothi* (Green). Dorsal view of complete specimen, ×4·5. Louisiana State University Geology Museum, Type Collection No. 8270.

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clearly be an advantage to any trilobite. Trilobites having this ability were most probably active, vagrant benthonic forms and not burrowers.

The specimen of *G. boothi* has the colour markings preserved on most of the axis, on a portion of the glabella, and on part of the pleura. On the glabella and axis, the spots are small and entirely random in arrangement. On the pleura, the spots have a secondarily symmetrical arrangement due to the two, generally linear, transverse rows per segment, though the number and the position of the spots varies.

It is probably safe to assume that *D. meridionalis* had the same ability as *P. rana* to change its colour to match its background. Perhaps the eyes would be sensitive to colour changes in the background and served to inform the trilobite of such changes. It is unlikely that trilobites which were either blind or which had reduced vision had this type of camouflage ability. Whether or not *G. boothi* and *Phillipsia*? *tenuituberculata* as described by Williams (1930) had this same ability, remains open to speculation. Both of these species show at least a partial arrangement of the black spots in rows.

The other two recorded examples of colour markings in trilobites appear to be of an entirely different type. Raymond (1922) described a pygidium of *Anomocare vittata* from the Cambrian of Alabama with slightly irregular light and dark bands becoming narrower across the axis. Wells (1942) reported several examples of *Isotelus maximus* from the Ordovician of Ohio, showing deeper shades of the same colour on different areas of the dorsal exoskeleton. These two types of colour markings are most probably due to carotenoid pigments, different from the melanin pigment forming the black spots occurring in the other cases of colour markings. The banding may have served to conceal the trilobite if it could be matched against an appropriate background.

In conclusion, it seems probable that there were many different types of colour markings in such a diversified group as the trilobites, as there are in modern Crustacea. Of special interest is the apparent ability of individuals of *Phacops rana* to conceal themselves by expanding or contracting the pigment in their chromatophores to match a light or a dark background.

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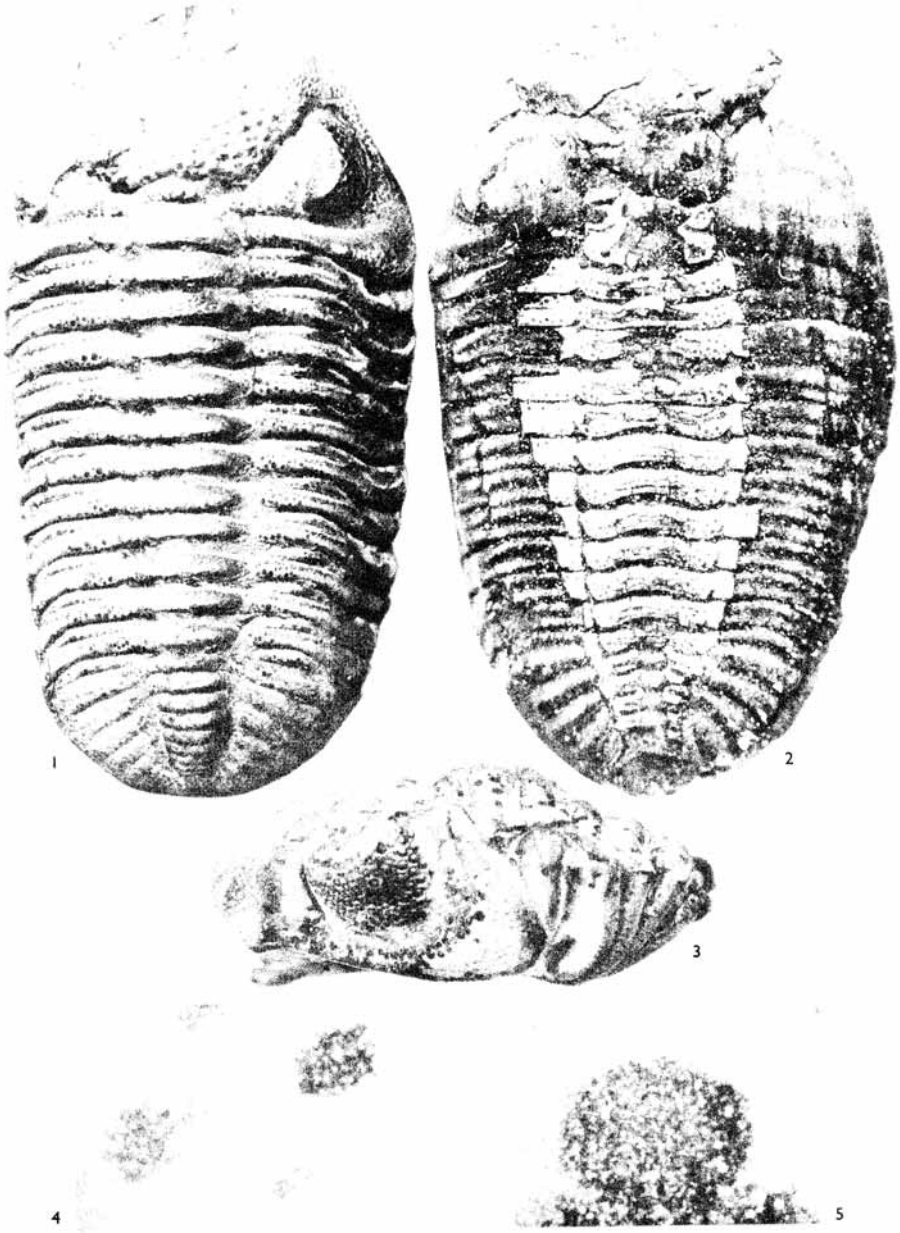

ESKER, Colour markings in trilobites