

2—*A New Trilobite from the Yeringian (Lower Devonian) Rocks of Kinglake, Victoria*

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Abstract

Dicranurus kinglakensis, sp. nov., is described, and compared with *D. longispinus* (Mitchell) from New South Wales, and *D. monstrosus* (Barrande) from Bohemia. The homologies of some parts are discussed, especially the genal spines. The Victorian beds containing *Dicranurus* are shown by the accompanying fossils to be Lower Yeringian in age. *Dicranurus* occurs in Devonian beds, except that in New South Wales *D. longispinus* is found in beds referred to the Silurian. The standing of the sub-genus *Bounyongia* is discussed.

Introduction

In the Kinglake District of Victoria there is a large synclinal structure in which is preserved a series of marine sediments of Lower Devonian age. From Davies' Quarry, on the western branch of Stony Creek, about a mile north of the Kinglake West State School, a rich faunule including the new species now described has been discovered.

Classification

The definition of the family of trilobites to which the new species belongs has been the subject of much debate. However, as a result of the researches of the Richters (1917, 1928, 1930), Reed (1925), Warburg (1925, 1933), and others, some general agreement appears to have been reached. The following classification has been adopted:

Order: OPISTHOPARIA Beecher, 1897

Family: ODONTOPLEURIDAE Burmeister, 1843

Genus *Dicranurus* Conrad, 1841

DIAGNOSIS—Odontopleurids with lobes isolated by well-developed "false furrows" from central part of glabella; small first lobes, large second and third lobes, and small fourth (occipital) lobes; median post-glabellar projection (of occipital origin) produced into two long posteriorly-directed recurved spines. Cephalon more or less semi-circular; free cheeks not anchylosed with fixed cheeks; eyes post-central. Thorax with nine segments (not proved in genotype but inferred from *D. kinglakensis*); the pleurae characterised by elevated ridge divided unequally by a furrow into a narrower anterior part and a wider posterior part, and extended distally into spines of unequal size corresponding with the pleural ridges in position and relative size. Pygidium with two long spines.

Dicranurus is very like the genus *Ceratocephala*, but in the latter the occipital spines are shorter, straight, divergent, and separate at their bases (i.e., not fused into a median post-glabellar projection); the free cheeks are anchylosed with the fixed cheeks; the cephalon is broader anteriorly than posteriorly; the eyes are pre-central; the pleurae are divided into equal parts by the median furrow.

DICRANURUS KINGLAKENSIS, sp. nov.

(Plate III, figs. 1-3)

TYPE MATERIAL—A holotype consisting of the cast of a carapace complete except for damage to the front of the cephalon. The matrix in which it is preserved is a bluish-grey indurated shale, with a thin band of brownish-grey sandstone on the opposite side of the slab from that preserving the fossil. University of Melbourne, Dept. of Geology, reg. no. 1936; collected and presented by Mr. A. A. Brunton. A paratype consisting of a cranidium in the same matrix; collected and presented by Mr. O. P. Singleton, B.Sc., M.U.G.D., reg. no. 1937.

Both holotype and paratype were collected from Davies' Quarry, west branch of Stony Creek, Kinglake West, Victoria.

THE CARAPACE—(described from holotype, pl. III, fig. 1), is 6.5 cm. long (anterior margin incomplete) and 4 cm. wide, exclusive in both measurements of the spines. The general outline is roughly that of an ellipse with the longer sides flattened. The carapace is strongly trilobed, and very spinose. The surface is covered with tubercles, large and small. In life, the cephalon must have been on a different plane from the thorax in order to allow room for the recurved occipital spines.

THE CEPHALON—(1) *The cranidium* (described from the paratype, pl. III, fig. 2), in its outline is characterised by almost straight lines. The sides of the cranidium make an angle of approximately 120° with the anterior margin. The posterior lateral angle of the cranidium is approximately 50° . Supporting the median post-glabella projection (characteristic of this genus) is a flat bracket (on each side), the outer border of which makes an angle of 35° with the median longitudinal axis of the cranidium. This bracket is fused to the fixed cheek, and passes over the level of the lateral extensions of the occipital segment at about half-way between the posterior lateral angle of the cranidium and the median post-glabella projection. This bracket carries the fourth lateral (occipital) lobe, which is small. The median post-glabella projection (Reed's "post-central lobe") is about three-quarters of the length of the median area of the glabella. It bears posteriorly two long curved hollow spines, the bases of which coalesce to form the post-glabella projection.

The "false furrows" of the glabella are relatively wide (1.5 mm.) and deep, and are parallel. The median lobe is thus rectangular in outline. The second and third lobes are sub-equal and relatively large and well-developed, but the first and fourth (occipital) lobes are small and little elevated. The degree of tumidity is shown in fig. 1B, which is a longitudinal silhouette of the paratype cranidium, and fig. 1A,

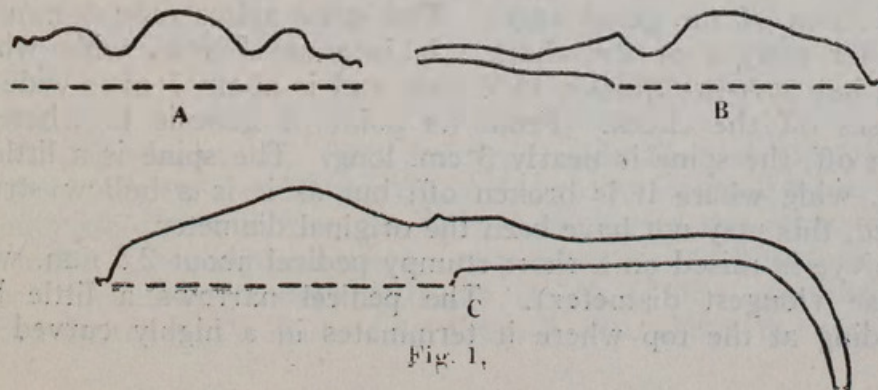


Fig. 1,

which is a transverse section of the same. The silhouette is given rather than a median section, so as to show the configuration of the occipital spines.

The spines on the fossils described in this paper usually have a median furrow due to collapse, such as is found in thin hollow shells like *Styliolina* (Gill, 1941). They have also fine transverse markings. The occipital spines bear tubercles.

The axial glabellar furrows ("true furrows") are but weakly developed anteriorly, although more strongly so posteriorly. A well-marked furrow borders the lateral margins of the cranidium. Another specimen (National Museum reg. nos. 14522 and 14523, which are counterparts) shows a similar furrow constituting a pre-glabellar field on the cranidium. The furrow and ridge of the occipital segment are well displayed at their lateral extensions outside the brackets already described.

The surface of the cranidium is well tuberculated, a particularly prominent tubercle being present on the median post-glabellar projection. National Museum reg. nos. 14522 and 14523 show this tuberculation particularly well. The tubercles show on both the cast and the mould, proving that they involved the full thickness of the exoskeleton, and were not merely external outgrowths. There are prominent tubercles on all the raised parts of the cranidium; some also form a row up the fixed cheeks between the axial furrows and the marginal furrows. Between the larger tubercles are numerous ones of smaller size.

The median post-glabellar projection is $\frac{3}{4}$ cm. long and 6 mm. wide. It covers the first segment of the thorax before dividing into two strong, hollow spines. These are 2 mm. in diameter at the cephalic end, and circular in cross-section. They diverge at first so as to make an angle of 40° between their axes, then become more parallel (see Pl. III, fig. 2). Only 1 cm. of the spines is preserved in the paratype. However, other specimens show that they were recurved, as is characteristic of *Dicranurus*, but not spirally as in *D. monstrosus*; they are more like the occipital spines of *D. longispinus* (fig. 1C shows the spines on a large specimen, Melb. Univ. Geol. Mus. reg. no. 1917).

(2) *Free Cheek* (described from M.U.G.D. reg. no. 1938, Pl. III, fig. 3). Width from margin immediately anterior to eye to margin immediately anterior to genal spine, 11.5 mm. Length taken at right angles to last line and on genal angle side of eye, 12 mm. Outer margin of cheek smooth, roundly curved, drawing in under the genal spine, which rises on the dorsal surface of the cheek instead of being a projection of the genal angle. The spine arises only 3 mm. from the inner margin of the cheek. It is about 7 mm. wide where it arises, but narrows quickly to 4 mm. and is about 3 mm. wide when it passes off the cheek. From its point of genesis to where it is broken off, the spine is nearly 3 cm. long. The spine is a little over 1 mm. wide where it is broken off, but as it is a hollow structure crushed, this may not have been the original diameter.

The eye is raised on a short stumpy pedicel about 2.5 mm. wide at its base (longest diameter). The pedicel narrows a little before expanding at the top where it terminates in a highly curved visual

area which looks oval to round from the dorsal aspect. The free cheek is tuberculated, the tubercles being grouped mostly round the base of the pedicel, and around the outer margin. Another specimen, an internal cast, shows the visual area to consist of numerous sub-hemispherical bodies (casts of inner surfaces of the lenses), much less than their own diameter apart. The eye consisted therefore of closely-packed, strongly convex lenses. There are 12 lenses per millimetre, so there must have been some hundreds in the complete eye. There is a definite rim in this specimen where the visual area begins. The pedicel is about 1 mm. high, and the visual area approximately the same.

The cranidia and the free cheeks show that the eyes were situated opposite the anterior end of the third glabellar lobe, and so post-central—a distinguishing feature from the closely allied genus *Ceratocephala*. In most cases, the free cheeks and cranidia are found separate, whereas these parts are fused together in *Ceratocephala*, and so the cephalon is usually found whole.

THE THORAX—(described from holotype) consists of nine segments. The thorax is more or less even in width (about 4 cm.) until the 7th segment, from whence the width is reduced gradually to align the margin of the thorax with that of the pygidium. The axis is prominent (anteriorly 1 cm. wide, or 1.5 cm. including nodules) and tapers posteriorly proportionately with the pleurae. Anteriorly the axis rises 4 mm. above the most elevated part of the pleurae. Nodules clearly developed; they are associated with the broader posterior ridge of each pleuron.

The part of the pleurae in evidence from the dorsal aspect of the trilobite consists of a broad, raised ridge divided by a shallow furrow into a wider posterior part and a narrower anterior part, the latter being roughly half the width of the former. Each pleuron is extended distally into two spines—a narrow, short anterior one, and a wider, long posterior one. Probably the relative development of these spines is connected with the relative size of the subsidiary ridges on the pleurae. It would appear from the holotype that the posterior spines are only of the order of a centimetre in length on the first three pleurae, and deflected backwards at an angle of the order of 45° to the longitudinal axis of the trilobite, whereas on the succeeding pleurae, there are long, strong spines up to 4 cm. (and perhaps more) in length, deflected so as to be approximately parallel with the longitudinal axis. The spines on the fourth and fifth segments are the longest. The respective length of the spines seems to be connected with their protective function when the trilobite is enrolled.

The thorax is tuberculate, there being two prominent tubercles on each segment of the axis, one in the middle of the wider subsidiary ridge of each pleuron, one where the heavier posterior spine is deflected, and sometimes others on the spines.

PYGIDIUM—(described from holotype). Small, and sub-triangular in outline. Greatest width 2.5 cm. and greatest length 0.8 cm. Three segments are discernible on the axis, declining in definition anterior-posteriorly. The segments have two tubercles on them as in the thorax. The axis is about half the length of the pygidium, well-rounded terminally, and standing about 3 mm. above the rest of the

pygidium. The most anterior segment has nodules on each side of the axis, and is produced into well-defined pleural ridges with strong furrows on each side. At about half the distance to the margin, the ridges are deflected backwards very strongly, and are produced beyond the margin into long strong spines, which are directed almost parallel to the longitudinal axis of the trilobite. The ridges on the pygidium have a central tubercle on them, as do their homologues in the thorax, the pleurae. Apart from the spines, the margin of the pygidium is smooth.

Specific Comparisons

The new species is compared with the following forms:

(1) *Dicranurus longispinus* (Mitchell, 1889; Etheridge and Mitchell, 1896), Pl. III, fig. 4. Etheridge and Mitchell referred this species to *Ceratocephala*, but it does not belong there because the free and fixed cheeks are not fused, the occipital spines are not straight, and separate at their bases (it has a post-glabellar projection), and the pleurae are not divided into equal areas by the pleural furrows. The form, on the other hand, has all the diagnostic features of the genus *Dicranurus*.

The type material has been examined and found to be very similar to our new species. Just as *Gravicalymene australis* (Etheridge and Mitchell), *G. angustior* (Chapman), and *G. cootamundrensis* Gill constitute a closely related gens, so do *Dicranurus longispinus* and *D. kinglakensis*. The new species is distinct from Mitchell's species in that it is altogether a more developed form of heavier build. This is illustrated in the following features:

- a. *Dicranurus kinglakensis* is typically much bigger than the latter. Comparison of a number of specimens shows it to be one-third or more larger.
- b. The carapace is more tumid (up to twice the elevation).
- c. It is more heavily tuberculated.
- d. The eyes are more prominent.
- e. Proportionately, the thoracic rachis is wider. The ratio width of rachis over width of thorax is 4:4.8 for *D. kinglakensis* and *D. longispinus* respectively.
- f. The pygidium is more robust in the former species. The ratio width over length for the two species is 2.6:3.15 respectively.

The pygidial spines are proportionately stronger.

Dicranurus kinglakensis is a more developed form than *D. longispinus*, and from this it may not be wrong to infer that it comes slightly later in the evolutionary sequence. Its stratigraphical position is discussed on page 13.

(2) *Dicranurus monstrosus* (Barrande, 1852). The cranidium of this species is very like that of *D. kinglakensis*, except that there is a marked difference in the spines. The original figure of Barrande (1852, Pl. 37, fig. 34) and the photographs reproduced by Rud. and E. Richter (1930, fig. 6) show that there is a difference of about 20° in the divergence of the spines; also the spines in our species and that of Mitchell curve downwards and perhaps a little outwards (although this may be due to crushing), but they are not spirally

recurved as are those of *D. monstrosus*. There are no branches on the spines of our species as figured for Barrande's species (R. and E. Richter, 1917, fig. 7). The eye pedicels of *D. monstrosus* are longer than in the new species.

(3) *Dicranurus hamatus* Conrad (1841). This species is the genotype for the genus *Dicranurus*, and comes from rocks of Lower Helderberg age. The figures vary somewhat, but apparently the lobation is much less distinct than it is in our species. The eyes in *D. hamatus* are situated much further back (Clarke, 1892, Pl. 1, fig. 6) than in *D. kinglakensis*. Moreover, the thoracic segments are of an altogether different construction, as also is the pygidium, if those figured by Hall (1861, Pl. 79, fig. 19) have been proved to belong to that species. It is interesting to note that each segment of the axis bears two tubercles (considered to be homologous with the occipital spines), an arrangement which holds for the species of *Dicranurus* known so far.

(4) *Dicranurus limenarcha* Clarke (1905) has only a superficial resemblance to the new species.

Associated Fauna

The following forms are associated with *Dicranurus kinglakensis*:

ANTHOZOA

Lindstroemia ampla Chapman.
L. yeringae Chapman.
Pleurodictyum megastomum Dun.
Pleurodictyum sp. nov.

BRACHIOPODA

Anoplia australis Gill.
A. withersi Gill.
Dalmanella aff. *elegantula* (Dalman).
Eospirifer sp.
Leptaena rhomboidalis (Wilckens).
Nucleospira australis McCoy.
Orbiculoides sp.
Plectodonta bipartita (Chapman).

PELECYPODA

Nuculites maccoyianus Chapman.
Palaconeilo sp.

TRILOBITA

Homalonotus sp.
Leonaspis sp.
Odontochile sp.
Proetus sp.
Scutellum sp.

OSTRACODA

Beyrichia sp.
Plumulites sp.

ECHINODERMATA

Rutroclipeus sp.

There were also collected starfish, brittlestars, carroids, crinoids, and polyzoa which have not been determined yet.

Stratigraphical Inferences

Anoplia of two species in good numbers and plentiful *Plectodonta bipartita* indicate a Lower Yeringian age (Gill, 1945). The rest of the faunule fits in well with this age determination. The type Yeringian sandstones, shales, and mudstones have been shown to be

Lower Devonian in age (Gill, 1942). *Dicranurus*, *Pleurodictyum* (two species present), and *Plectodonta* of the *P. comitans* type (cf. *P. bipartita*) are Devonian forms in overseas faunas. *Dicranurus kinglakensis* is very close to *D. monstrosus* from Étage G of the Bohemian Devonian. The present writer has previously drawn attention to the affinities between the Bohemian Devonian fauna and the Yeringian faunas of Victoria. This is well illustrated in the case of the trilobites, as the following table shows:

Victorian Form	Compared Bohemian Form	Étage
1 <i>Acanthopyge australis</i> (McCoy)	<i>A. haueri</i> (Barrande)	F
2 <i>Calymene killarensis</i> Gill	<i>C. blumenbachi</i> Brongniart	E F
3 <i>Cheirurus</i> aff. <i>gibbus</i> Beyrich	<i>C. gibbus</i> Beyrich	F G
4 <i>C. sternbergi</i> (Boech)	<i>C. sternbergi</i> (Boech)	E F G H
5 " <i>Dalmanites meridianus</i> " Eth. & Mitch.	<i>D. (=Odontochile) hausmanni</i> Brongniart	G
6 <i>Gravicalymene angustior</i> (Chapman)	<i>G. interjecta</i> (Corda)	F G
7 <i>Phacops fecundus</i> Barrande	<i>Phacops fecundus</i> Barrande	E F G H
8 <i>Scutellum greeni</i> (Chapman)	<i>S. formosus</i> (Barrande)	G

The above determinations are not all according to modern standards; e.g., the *Phacops fecundus* found here varies from that found in Bohemia. The name *Dalmanites meridianus* has been used by various authors to cover a closely related series of forms referable to the genera *Dalmanites* and *Odontochile*. The form at Kinglake is an *Odontochile*. Nevertheless, the similarities are striking and not without significance.

On the other hand, the Yeringian fauna is not one completely of Bohemian aspect. As already shown (Gill, 1942), there are affinities with other Boreal faunules, especially in North America.

Our new species of *Dicranurus* is very close also to *D. longispinus* from the Hume Series in New South Wales, which have been referred *in toto* to the Silurian (Brown, 1941). The bed containing *Dicranurus* also contains *Pleurodictyum*, although Dr. Brown is of the opinion that the N.S.W. form is not comparable with the genotype (personal communication).

Palaeozoological Features

SPINES. The high degree of spinosity of *Dicranurus kinglakensis* is a notable feature. The spines are hollow, and so aided a floating habit for this trilobite. They would be lined by at least one layer of cells, because the spines are part of a secreted exoskeleton, but the centre may have been occupied by light parenchymatous tissue or a blood sinus.

The considerable surface area of the numerous spines would provide a good deal of friction with the water, and thus aid floating, just as the appendages of some crustacean larvae do. The action may be compared with a snowshoe preventing sinking into snow, or the large surface area of a camel's foot-pad preventing sinking into sand.

Such spinosity of trilobites is frequently associated with the elevation of the eyes on pedicels. Both are adaptations to a planktonic

habit. The spines helped to keep the animal afloat, and the eyes on pedicels more readily descried danger. A trilobite half obscured in the mud of the sea floor did not need the sharp lookout necessary for a planktonic form. One notes the large eyes of crustacean larvae and other forms of marine plankton. When danger came, the trilobite rolled itself up, presenting the enemy (in the case of *Dicranurus*) with a chitinous spheroid well armed with spikes. The spines may thus be regarded as having a protective as well as a flotation function. A third function is that of balancers, like the outriggers on Pacific islanders' canoes. This would apply particularly to the big outstretched genal spines of *Dicranurus*.

The radial arrangement of the spines in the genus *Radiaspis* suggests that it was adapted for floating without locomotion. In *D. kinglakensis* and *D. longispinus* (the only species of the genus where the complete thoraces are known) the long thoracic spines and the pygidial spines are carried backwards in a streamlined fashion. This is clearly an adaptation to floating *with* locomotion. The movement, however, would be in one direction only. The adaptation was for forward movement, the deflection of the spines being disadvantageous for any quick backwards movements as seen in some modern crustacea. (It is not suggested that the Trilobita should be classified as Crustacea.) One imagines *Dicranurus* floating among the plankton or swimming gently forwards. Like the rest of the Odontopleuridae, it is highly adapted and specialised. Other Odontopleurids are present with the new species, but material good enough for description was not collected.

It is imagined that the spines would complicate moulting. As the spines would have to be renewed at each ecdysis, cells capable of secreting a new exoskeleton must have lined the inner surface of the spines. At moulting, the newly forming spines would need to be withdrawn from the old ones. As apparently the animal emerged from the front of the old armour, the backwards deflected spines would be easier of egress than the radially orientated spines of *Radiaspis*, or the long, slender curved spines of *Ancryopyge*.

OCCIPITAL STRUCTURES. The interpretation of the median post-glabbellar projection with accompanying brackets and spines as occipital structures (Warburg, 1933), seems to have found acceptance rather than their interpretation as glabbellar ones (Reed, 1925). The study of the Australian species of *Dicranurus* brings support for Warburg's view, it being possible to demonstrate the intimate relationship between the obvious part of the occipital segment, the post-glabbellar projection and the brackets.

The brackets carrying the occipital lobes illustrate a well-known architectural principle for buttressing a member carrying heavy strain. The long occipital spines must have transferred considerable strain to the projection carrying them. The projection stands about 3 mm. above the lateral extensions of the occipital segment in *D. kinglakensis*, and projects back half a centimetre over the thorax. The brackets provide excellent support for this structure which needs it in view of the relatively big strain carried. The brackets link the fused bases of the spines (i.e., the post-glabbellar projection), the lateral extensions of the occipital segment, and the glabella and fixed cheeks.

I agree with Warburg in considering the occipital spines homologous with the tubercles on the occipital ring. *Dicranurus kinglakensis*, like all other species of this genus of which the thoracic segments are known, has two tubercles in a like position on the axis of each segment of the thorax and pygidium. Judging by the faint tubercles on the pygidium of *D. longispinus*, the same arrangement probably existed there. The very prominent tubercle behind the median glabellar lobe in *D. monstrosus*, *D. longispinus*, and *D. kinglakensis* may be regarded as an incipient spine.

Writers have drawn attention to the fact that the cephalon and thorax of *Dicranurus* could not have been in the same place, because of the large occipital spines curved down below the level of the cephalon. The orientation of the trilobite must have been therefore one of the following:

(a) For the thorax and pygidium to form an obtuse angle with a horizontal cephalon (the angle would be of the order of 140° - 150° in the case of *D. kinglakensis*). This would considerably increase friction with the water in locomotion, and decrease the friction assisting flotation. The same would apply to a partially enrolled condition. The thorax and pygidium could have been horizontal and the cephalon inclined downwards; this would interfere with rear vision.

(b) For the thorax and pygidium to be curved so that the dorsal surface of the trilobite was concave, a stance illustrated for *Ceratarges* by R. and E. Richter (1930, fig. 5). This arrangement (if not extreme) would produce less friction in locomotion than (a), and would affect the animal's flotation to no appreciable extent. This appears to me to be the more likely attitude of the animal in life, as it is a better adaptation.

However, it is difficult to imagine how the occipital spines were accommodated in *D. monstrosus*. Clarke (1892, Pl. 2, figs. 1, 2) and the Richters (1930, fig. 6) show that these spines were recurved to an extreme degree, and so the animal must have remained partially enrolled, or its body must have been at nearly right angles to its head. Both these attitudes are amazing, especially for a planktonic form. This appears to be an example of a specialisation being carried to extremes, and so becoming a liability instead of an asset.

It has been suggested that these occipital spines were the beginning, in this group, of the provision of a thoracic cover (cf. extant crustacea). When *Dicranurus* was enrolled, these strong long spines did provide some protection for the thorax, but they appear to have been a disadvantage when the animal was not enrolled.

GENAL SPINES. Reed (1925, p. 423) has drawn attention to the phenomenon of genal spines which rise from the dorsal surface of the free cheeks instead of being projections of the genal angles as is usually the case. He questions whether these genal spines are really homologous with the usual genal spines. The alternatives appear to be:

(a) That the spines are outgrowths of the rolls of the free cheeks, or the hypertrophy of tubercles thereupon. One may compare here the probable origin of the occipital spines from tubercles on the occipital segment.

(b) That the spines are true genal spines (being outgrowths of the margin of the exoskeleton in the same way as the thoracic spines are), but whose bases have extended back over the surface of the free cheeks.

I incline to the latter opinion (in the case of *D. kinglakensis* at least), because there is no genal angle underneath the spine. A specimen giving a good lateral view of the free cheek shows that the lateral and posterior margins of the free cheek curve in quite strongly under the spine, rising to flow outwards as its ventral surface. If a free cheek with normal genal spine were made of plastic material, and the spine then pushed in towards the eye, the structure would simulate that found in *D. kinglakensis*. If the spine in this species were an hypertrophy of a dorsal tubercle or otherwise an outgrowth of the dorsal surface of the free cheek, then one would expect to find a more or less normal genal angle, even if somewhat fused with the spine above.

PYGIDIUM. A point of interest in *Dicranurus* which one has not seen commented upon is that the deflection of the segments fused in the pygidium is not marginal (as in the thorax), but about half-way between the pygidial rachis and the margin of the pygidium. This suggests that in the fusion of the elements of the exoskeleton that form the pygidium, the coalescence extended beyond the pleurae so affected, and filled in between the deflected pleural spines, thus placing the angle of deflection upon the surface of the pygidium instead of at the margin. Such a deflection of segments in the pygidium is rare among trilobites.

Palaeoecology

Dicranurus kinglakensis occurs at Davies' Quarry, Kinglake, in a band where it is associated with a number of other trilobites. Not far from the trilobite band is a coral band in which *Lindstroemia* and *Pleurodictyum* predominate. Corals are an inconspicuous element in the trilobite band, and the trilobites a minor feature of the coral band. In sorting out loose blocks on the floor of the quarry, one can readily say from which band each fossiliferous block comes. The matrices appear to be the same, but obviously there must have been some definite ecological difference. The similar matrices show that there was a similar mud floor in each case. As the corals are affected so conspicuously, temperature may have been the variant. A warmer current may have encouraged the development of corals at one time, and a cooler current favoured the trilobites at another.

The structure of *Dicranurus kinglakensis* indicates that its habit was planktonic (cf. Ruedemann, 1934). It is remarkable how such forms are often limited in their geographical distribution as far as their apparent fossil occurrence is concerned. *Dicranurus* has been found in the Kinglake area only of the Yeringian, just as *Acanthopyge australis* (McCoy) appears to be limited to the Killara area, although common there and a planktonic form (Gill, 1939). On the other hand, mud-loving trilobites like *Phacops* seem to be ubiquitous in the Yeringian Series.

In Davies' Quarry there is a third band presenting yet another quite distinct assemblage. It is characterised by numerous echino-

derms (carpoids, crinoids, and probably blastoids), asterozoa (starfish and brittle-stars), and trilobites. No starfish was found in the other two horizons, and the only echinoderms were crinoids.

Note on the Subgenus *Bounyongia*

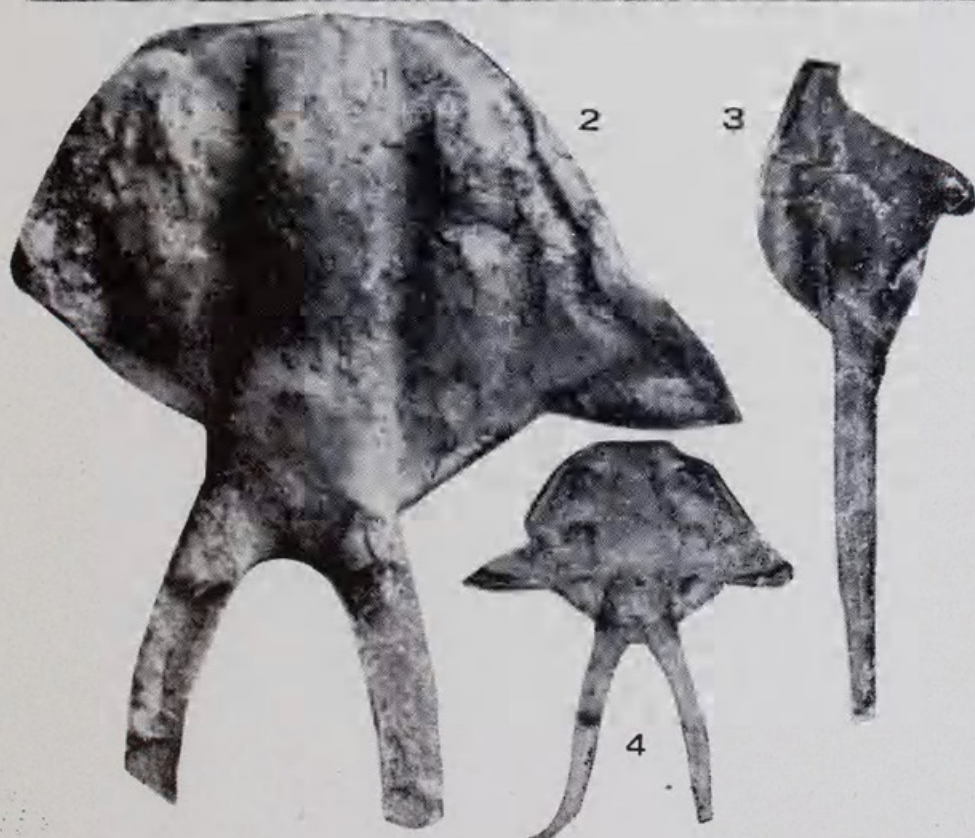
The referring of *Ceratocephala longispina* in this paper to the genus *Dicranurus* brings into question the standing of the subgenus *Bounyongia* (Etheridge and Mitchell, 1917, pp. 497-8). The type specimens (Pl. 26, figs. 12-13; Pl. 27, fig. 14) have been examined; they are somewhat crushed. They are not referable to the genus *Dicranurus* because the cephalon is broader anteriorly than posteriorly, the free cheeks are fused to the cranidium, the spine bases are separate, and the eyes are pre-central. Cowper Reed has mentioned the imperfection of the specimens (1925, p. 417), and Warburg (1933, p. 14) has expressed doubt about the feature on which the subgenus was based, i.e., the emergence of spines from the glabella. After examining the specimens, I am in agreement with Warburg that the spines are occipital, and therefore present no new feature upon which a subgenus could stand. Both specimens show a prominent central tubercle in the area between the central portion of the glabella and the spine bases, such as is seen in *Dicranurus*. As the subgenus was founded on a misinterpretation, it must now lapse.

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