TRILOBITES

Introduction to Trilobites:

These groups of arthropods have no living members and are represented only by fossils. Altogether 19 genera are known to have had included nearly 4000 species. A fossil trilobite was first discovered in the year 1698, but was then wrongly identified as the skeletal frame of a flat fish.

The trilobites practically have no resemblance with the modern arthropods . The actual affinity of trilobites has not yet been conclusively proved, but it is definite that these fossils, in addition to their specific characters, have features common to arachnids and crustaceans. The trilobites are undoubtedly the oldest arthropods but nothing is known about their origin.

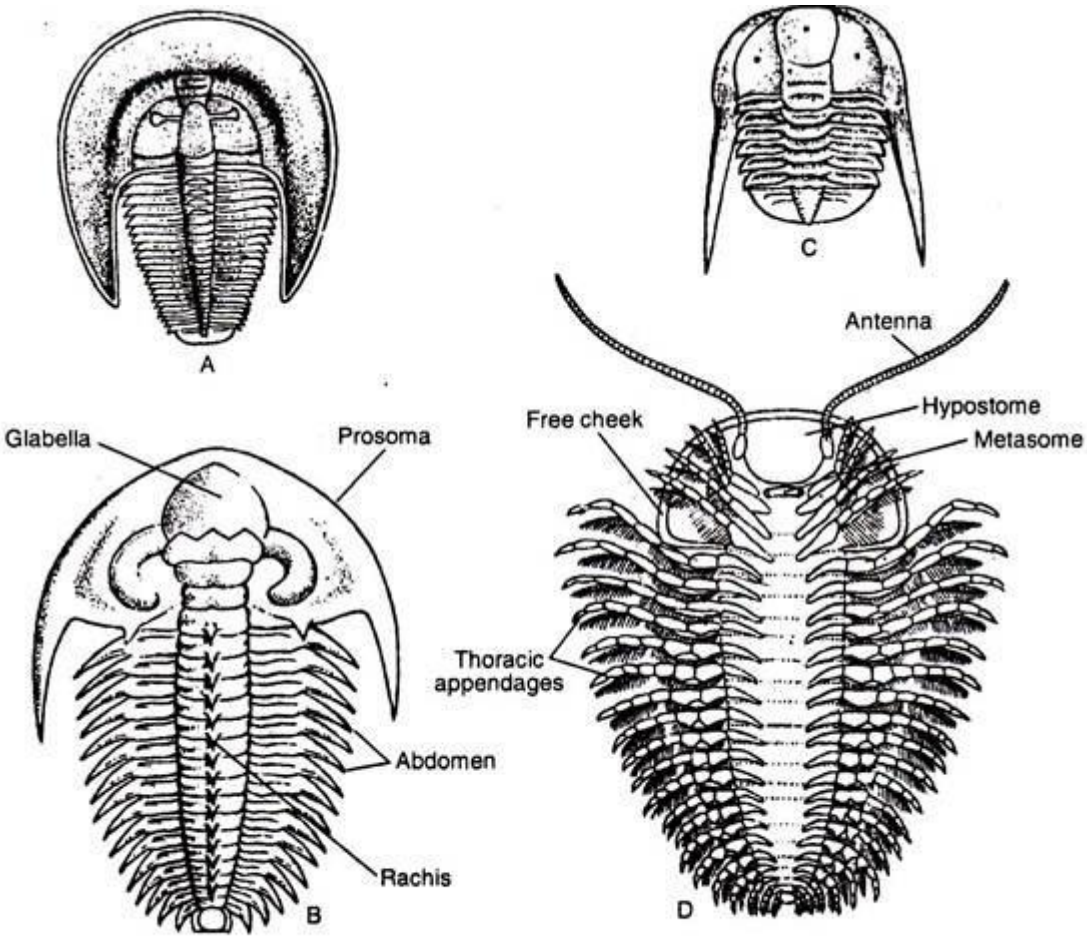

Fig. 18.32: A few Trilobites. A. *Harpes ungula*. B. *Holmia kjerulfi*. C. *Trinucleus bucklandi*. D. *Triarthrus becki*. All Trilobites are represented only by fossils (after Sedgwick).

Habit and Habitat of Trilobites:

All the trilobites were marine animals as indicated by the fact that their fossils were found from beds which contained the fossils of various other marine animals. The trilobite fossils were found from Precambrian and Cambrian beds and they became extinct before the end of Permian period.

These arthropods were believed to crawl in the ocean substratum and were able to swim up to certain height. Nothing is known about their feeding mechanism and other behaviours. The trilobites were distributed throughout the world.

Structure of Trilobites:

The size varied from 8 mm of the fossils (Agnostus) to 75 cm (Uralichas). The body of trilobite was dorso-ventrally flattened and the most distinguishing feature was that two longitudinal lines divided the body into three lobes—median or axial part in the middle and two lateral or pleural parts on the sides

Such divisions have given this group the name, trilobita. Like other arthropods, the body of trilobite was divisible into three parts—head or cephalon or prosoma, thorax and abdomen or pygidium. The thorax and abdomen together constituted what is known as opisthosoma. The entire exoskeleton was calcareous.

The exoskeleton which enclosed the head region is called cephalic shield or carapace. The region of carapace enclosing the axial part is called glabella and which shields the pleural parts is known as cheek or genae. The segments of the head region were distinctly recognisable from the impressions of transverse furrows on the glabella.

The last cephalic segment is called occipital or neck ring and the furrow which separates it from the thorax is called neck furrow. The neck furrow extends within the cheeks of both the sides.

The furrows are more prominent in primitive forms than in the comparatively recent types. The cheeks are divided by a longitudinal facial suture into inner fixed cheeks and outer free cheeks. The carapace bends ventrally to form a rim, called doublure

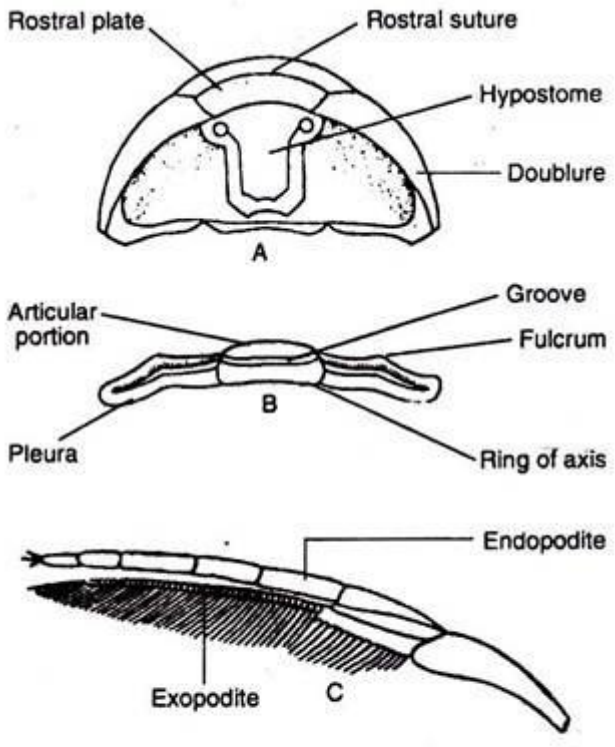

Fig. 18.33: Diagrammatic view of different parts of a Trilobite. A. Ventral side of head. B. One thoracic segment. C. A thoracic appendage (after Sedgwick).

The number of segments in the thoracic region varies from 2 (Agnostus) to 26 (Harpes). All the thoracic segments are free. The free segments helped the trilobite to coil up.

In each thoracic segment the axial part consists of:

(a) Broad belt-shaped ring,

(b) A knotched groove and

(c) Articular portion.

The pleural-parts of each thoracic segment is bent and divided into:

(a) Flat internal part and

(b) Slender external part.

The bending of the pleural part is called fulcrum, which may bear a triangular facet for articulating with the preceding segment.

The number of abdominal segments varies from 2-28 and all are fused. The shape of the abdomen is variable in different trilobites. It may be semi-circular, triangular or semi-parabolic.

Following structures are seen in trilobites—eye, labrum or hypostome, macula, mouth and different appendages:

Eye:

Some trilobites were without eyes (Agnostus, Microdiscus). In certain forms, e.g., Trinucleus, eyes are simple. But in most a pair of compound eyes is placed on the free cheeks. In most cases, the eyes are sessile but in some immovable stalks are present. But in all the forms eyes are placed on palpebral lobes, which are formed by the parts of free cheeks.

Three types of compound eyes are seen in trilobites:

(a) Holochroal:

Lenses are closely approximated and are globular or biconvex. The cornea extends over the entire surface of the eye.

(b) Prismatic:

Smooth cuticle covers the entire surface of the eye. The closely approximated hexagonal lenses are prism-like and planoconvex.

(c) Schizochroal:

Schizochroal the carapace separates the biconvex lenses which are circular in outline. The cornea thus does not form a continuous covering over the entire eye. The number of lenses in the eye may be variable. The number of lens increases from young to adult but decreases in the old forms. Within each eye, the lenses remain arranged in alternate rows.

Labrum or Hypostome:

These are plates which remain attached with the ventral doublure. The shape of the plate may be either square or oval. In Triarthus, a lower lip plate or metastomi is seen to be present immediately after the hypostome.

Macula:

These are present behind the labrum as a pair of elliptical or oval small patches. In many trilobites, the surface of the maculae is smooth and glossy and in others each macula is surrounded by either an elevated border or pits or tubercles.

Mouth:

The mouth is placed close to the hypostome and where the metastoma is present it lies between it and the hypostome.

Appendages:

The structure of appendage is well studied in forms like Triarthrus. One pair of appendages are present in each segment excepting the anal segment. The first pair of appendages which are called antenna are uniramous and the rest are bi- ramous. The antennae are placed on the sides of the hypostome.

Each antenna has a single flagellum which is composed of numerous conical joints. Each thoracic appendage consists of a small coxa having inwardly directed cylindrical prolongations which form gnathobases or endites. Both the exo and endopodites are of same sizes but structures are different.

The exopodite has a long proximal joint with serrated edge and a distal part of ten or more joints which have lining of setae along the posterior border. The six- jointed endopodite gradually tapers at the end.

The abdominal appendages are of two types:

(a) In the anterior part of the body appendages resemble thoracic legs and

(b) In the posterior part of the appendages are provided with broad and flat endopodites.

Development of Trilobites:

The development is known only in few instances. The earliest developmental stage of trilobite is known as protaspis. It has a length of 0.4 mm to 1 mm. The shape of protaspis is circular or oval. The cephalon is large with five distinct segments in its axial part. The abdomen is small.

From the examination of fossils of different stages, it has been assumed that development of trilobite fromprotaspis stage passed through following changes:

(i) Modifications in the shape and size of glabella,

(ii) Number and depth of the furrows in glabella increased,

(iii) Free cheeks grew in size,

(iv) Facial suture and eyes moved inwards,

(v) Number of thoracic segments increased,

(vi) Size of the head decreased.

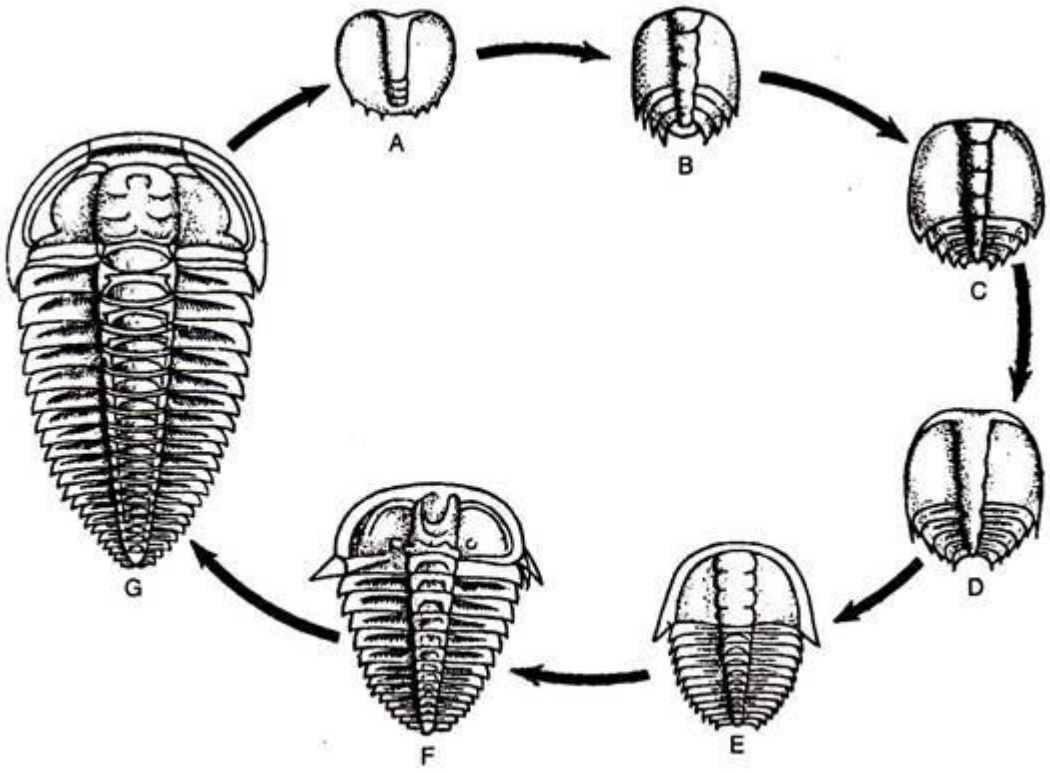

Fig. 18.34: Life history of a Trilobite, based on the fossils at different stages of development. A. Protaspis stage. B-F. Successive stages of development. G. Adult (after Sedgwick).

Affinities of Trilobites:

The trilobites are the oldest of all arthropods and bear a number of primitive characters—1. Presence of innumerable number of thoracic and abdominal segments. 2. Arrangement and nature of appendages. 3. Head region together with its appendages is unspecialised. Two other groups of arthropods—Xiphosura and Crustacea are believed to have some relationship with the trilobites.

Affinities with Xiphosura:

The Xiphosura are chelicerates which include the Limulus.

Following features are common in both trilobites and Xiphosura:

(i) Body is divided into three lobes.

(ii) Cephalothorax bears lateral eyes.

(iii) Appendages are biramous,

(iv) Presence of lateral spine in the pleura.

(v) Larval stage of Limulus resembles the appearance of trilobite and is known as trilobite stage.

In spite of these resemblances there are certain points of dissimilarity which speak against such affinity:

(i) Presence of antenna in trilobite.

(ii) Presence of five pairs of cephalic appendages in trilobite.

(iii) Thoracic and abdominal appendages are biramous in trilobite.

(iv) Presence of larbrum or hypostome in trilobite.

(v) No genital operculum is present in trilobite.

(vi) Protaspis larva of trilobite has no semblance with the Limulus larva.

Affinities with Crustacea:

The affinities with crustacea are claimed because a few groups of crustacea like Phyllopoda, Leptostraca, and Isopoda were present in the fossil beds where the trilobites were found.

Relationship with Phyllopoda:

This group includes crustaceans like Triops (Apus) and Branchipus.

The trilobites resemble these forms on following features:

(i) Presence of several variable trunk segments.

(ii) Presence of a prominent labrum.

(iii) Presence of gnathobases or endites on thoracic appendages.

(iv) Presence of a single pair of antennae resembles certain kinds of Triops, where second pair of antennae is rudimentary.

But the trilobites differ from the phyllopods in having:

(i) Less specialised cephalic appendages.

(ii) All appendages, excepting antennae are biramous.

(iii) Eyes are present on free cheeks.

(iv) Abdominal segments are fused.

(v) All abdominal segments bear appendages.

(vi) Body is distinctly divided into axial and pleural lobes.

Relationship with leptostraca:

This group includes forms like Nebalia, Paranebalia.

Trilobites resemble these crustaceans in following features:

(i) Segments are of same number (specially a trilobite, called Holmia, resembles the Nebalia.

(ii) Less specialised nature of maxillae and mandibles.

(iii) Structure of thoracic legs resembles the Paranebalia in having long exo- and endopodites.

Relationship with isopods:

The trilobites resemble these groups of crustaceans in following features:

(i) Body in both is dorso-ventrally flattened.

(ii) Body is divided into three regions— head, thorax and abdomen.

(iii) Eyes are sessile

In spite of these similarities, the structure of thoracic segments and construction of appendages differ markedly in the two groups.