

I. Summary

The postcranial skeleton of the Late Jurassic *Henkelotherium guimarotae* (Holotheria. Mammalia) exhibits a combination of primitive (e.g. humeral condyles) and modern characters (e.g. slender femoral neck and hemispherical head of the femur), determining the early evolution of the therian "Grundplan". Some of the modern therian characters that were already present in *Henkelotherium* (e.g. supraspinous fossa of the scapula) have been conserved in the later course of mammalian evolution, and have persisted until today with little variation in all therian taxa. *Henkelotherium* shares with small Recent marsupials (Didelphidae) and placentals (Tupaiaidae) certain characters (e.g. proportions of the vertebral column, asymmetric condyles of the femur), suggesting that its mode of locomotion was similar to that of these modern small mammalian species.

A revised reconstruction of the postcranial skeleton of *Henkelotherium* is given on the basis of: i) a detailed comparative anatomical investigation, ii) cineradiographic analysis of the locomotion of Recent small mammals. The new reconstruction includes an estimation of the body length and of the length of each segment of the vertebral column of *Henkelotherium*. The osteometric proportions of *Henkelotherium* were compared with those of Recent mammals of similar size. The vertebral columns do not show considerable variations in the studied species with the exception of the sacrum and the tail, the latter being particularly long in *Henkelotherium*. The long tail of *Henkelotherium* is interpreted as a steering device for locomotion.

The proportions of the limb segments are almost equal in length in *Henkelotherium* as in most of the generalized small mammalian species studied.

However, the phalanges of *Henkelotherium* are particularly elongated and are provided with distinct tubercula strengthening the attachment of the retinaculum of the flexor muscles of hand and foot. These adaptations could have facilitated the locomotion in a complex structured habitat by improving grasping strength and holding ability.

Epipubic bones are present in *Henkelotherium*. The locomotor role of the epipubic bones and the muscles attaching to the epipubes were studied in *Monodelphis domestica*. Probably, the epipubes contribute to establish a functional connection between the abdominal region and the thigh in living marsupials and monotremes. A similar role of epipubic bones is assumed for *Henkelotherium* and other early mammals.

The flexibility of the vertebral column is a critical feature for the modern locomotor pattern of modern mammals and probably was already present in *Henkelotherium*. Using cineradiographic studies two different modes of sagittal flexion of the vertebral column were identified in two Recent therian mammals: i) flexion concentrating in the caudal thoracic region (*Monodelphis domestica*), ii) arch like flexion of the entire thoracic and lumbar region (*Micromys minutus*).

In order to give a more precise terminology definitions are proposed and consequently applied in this work (e.g. climbing, arborealism, scansorial locomotion).

As a consequence of small body size, Recent small mammals are frequently confronted with irregularly spaced substrates requiring the ability of scansorial locomotion. The small body size, the advanced anatomy and proportions of the postcranial skeleton of *Henkelotherium* suggest a similar type of locomotion. This is supported by the paleoecological reconstruction of the Guimarota ecosystem that indicates a densely vegetated environment.