The talus is a little higher than the articular process. A large knob extends forwards from the talus, convex distally, for the navicular. Both this portion of the talus and the navicular have been broken obliquely. Ventrally, there are two large facets that fit on to the calcaneum. The median facet is flat, the lateral one concave and elongated antero-posteriorly. Between them is a deep groove.

The calcaneum (fig. 35c) is compressed laterally, with a long posterior manubrium to which attached the gastrocnemius ligament. The distal end which receives the astragalus widens, and the median flat facet (sustentaculum) projects from the side considerably. This projection serves as a buttress under which runs the ligament of the foot extensor. The lateral facet is very convex and raised above the level of the median one. Distal to this, a thick ledge juts out from the lateral side. The distal face which adjoins the cuboid is circular and slightly concave.

Only the medial portion of the navicular is preserved (fig. 35g). From what is present, the bone was flattened antero-posteriorly, almost disc-shaped. The proximal face is extremely concave. Medially, the surface is vertical and slightly irregular and the dorsal face is flat.

Most of the cuboid is present, except for a portion which has been sheared off from the dorsal surface (fig. 35e and f). The proximal face is vertical and slightly convex and fits on to the calcaneum. On the distal face is a very deep oblique groove which continues round on to the lateral surface. This would have contained the ligament of the digital flexor. On the dorsal side of this groove are two facets: a large vertical medial one for metatarsal IV and a smaller oblique lateral one for metatarsal V.

At the extreme proximal end of the medial surface, there is a
small flat circular facet in the posterior corner with a large depression above it. This would have joined with a facet on the lateral side of the navicular. The facet for the ectocuneiform is visible distally, but most of it has been broken off. It appears to have been elongated and directed obliquely. The ectocuneiform is not preserved, and neither is the mesocuneiform.

The ventral surface is largely concave, bounded distally by a prominent tubercle.

Specimen 16202M

Specimen 16202M comprises the nearly complete right manus and a few elements from the left manus of a large felid. The bones were found, not completely disarticulated, but slightly disturbed, and were numbered and listed before being prepared from the matrix.

<table>
<thead>
<tr>
<th>No.</th>
<th>Right radius</th>
<th>No. 19</th>
<th>Right 2nd phalanx V</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 2</td>
<td>Right ulna</td>
<td>No. 20</td>
<td>Right sesamoid</td>
</tr>
<tr>
<td>No. 3</td>
<td>Right pisiform</td>
<td>No. 21</td>
<td>Right sesamoid</td>
</tr>
<tr>
<td>No. 4</td>
<td>Right scapho-lunar</td>
<td>No. 22</td>
<td>Right sesamoid</td>
</tr>
<tr>
<td>No. 5</td>
<td>Right trapezium</td>
<td>No. 23</td>
<td>Right sesamoid</td>
</tr>
<tr>
<td>No. 6</td>
<td>Right cuneiform</td>
<td>No. 24</td>
<td>Right sesamoid</td>
</tr>
<tr>
<td>No. 7</td>
<td>Right trapezoid</td>
<td>No. 25</td>
<td>Right sesamoid</td>
</tr>
<tr>
<td>No. 8</td>
<td>Right unciform</td>
<td>No. 26</td>
<td>Unidentifiable</td>
</tr>
<tr>
<td>No. 9</td>
<td>Right magnum</td>
<td>No. 27</td>
<td>Right sesamoid</td>
</tr>
<tr>
<td>No. 10</td>
<td>Right metacarpal I</td>
<td>No. 28</td>
<td>Left scapho-lunar</td>
</tr>
<tr>
<td>No. 11</td>
<td>Right 1st phalanx I</td>
<td>No. 29</td>
<td>Left trapezoid</td>
</tr>
<tr>
<td>No. 12</td>
<td>Right metacarpal III</td>
<td>No. 30</td>
<td>Left trapezium</td>
</tr>
<tr>
<td>No. 13</td>
<td>Right metacarpal IV</td>
<td>No. 31</td>
<td>Left radial sesamoid</td>
</tr>
</tbody>
</table>
No. 15  Right 3rd phalanx I  No. 32  Left metacarpal I
No. 16  Right metacarpal II  No. 33  Left 1st phalanx I
No. 17  Unidentifiable fragment  No. 34  Left sesamoid
No. 18  Right 1st phalanx V  No. 34a  Left 3rd phalanx I
No. 35  Unidentifiable fragment

The radius (fig. 36a)
The distal portion of the right radius has a triangular shaft, with the acute apex on the medial side. At the distal extremity, this acute angle is extended out into a thin flange. The anterior face of the shaft is flat, the posterior face slightly concave. A small broken area flush with the anterior surface indicates that a projection or tubercle has been broken off. The lateral side of the shaft is sharply delimited on either side and is rather concave, so that it appears to be bordered by two parallel crests.

The distal face is a very concave ellipse, which receives the scapho-lunar. It is elongated transversely with a downward extension on the medial side. On the posterior side, a prominent rounded tuberosity forms a thick ledge before passing up into the shaft. This tuberosity continues on to the lateral surface where there is a well-defined concave oblong facet for the ulna. The anterior surface is smooth. The posterior tuberosity provides a reinforcement for the tendons of the digital flexors.

The ulna (fig. 36b)
The radius had become dissociated from the ulna and scapho-lunar, and the distal end of the ulna was found in contact with the rather disorganised elements of the carpus. It is triangular in section, with the medial surface flat and the lateral surface sharply rounded,
becoming more acute proximally. The antero-lateral and the postero-lateral sides meet the medial side sharply, forming crests. The posterior crest is more accentuated, marking the insertion of the forearm flexors.

The medial facet for articulation with the radius is set on a slight prominence. It is flat to convex. The distal end of the ulna is transversely compressed and the cuneiform facet rounded.

The carpals

The right scapho-lunar (fig. 36c and d) is complete; the left has its proximal portion sheared off by the blasting of the breccia. In the right one, the proximal face is concave, fitting the facet on the radius. On the lateral side there is a small depression which adjoins the cuneiform. Distally, the surface is an irregular series of facets for the close union of the second row of carpals. At the lateral edge, there is a smooth saddle-shaped facet for the unciform, followed by a deep depression for the magnum. Next to and anterior to this there is a slight oblique ridge and a rather flat area at the extreme antero-medial edge, corresponding to the trapezoid. The medial surface is elongated antero-posteriorly with a flat posterior facet for the radial sesamoid. The anterior surface is smooth and the posterior is uneven.

The cuneiform (fig. 36e) is rather pyramidal in shape. The lateral side has two facets, a flat triangular one distally for the pisiform and a narrow elongated one proximally for the ulna. The medial side is taken up by an elliptical concave facet for the unciform. The anterior surface is narrow and compressed laterally.

The pisiform (fig. 36f) is large and elongated transversely. The distal extremity is expanded into a rounded knob-like structure with an irregular surface. On the posterior side, this knob ends abruptly in
in a sharp ridge, and next to it is a deep groove. Both these structures strengthen the tendons of muscles running down to the wrist and digits. The proximal surface is flat and sub-triangular and joins the flat facet of the cuneiform.

Both left and right trapezia are exactly similar (figs. 36g and h). They are elongated antero-posteriorly and rather crescent-shaped. On the lateral face, a large facet stretches round proximally and anteriorly to meet the trapezoid. Postero-laterally is a circular flat facet to accommodate the second metacarpal. The medial surface is smooth and concave for articulation with metacarpal I. The proximal facet that adjoins the scapho-lunar is large but not very well defined.

The trapezoid (fig. 36k) is a pyramid-shaped bone with a broad rather convex anterior face. It tapers posteriorly to a small oblique face. On the proximal side, facing the scapho-lunar are two facets; a deep concave oblique one, with a flat semi-circular one medial to it. The distal surface is smooth and convex, for articulation with the greater part of metacarpal II.

The magnum has a very irregular shape (fig. 36i and j). It has proximally a large rounded prominence stretching from anterior to posterior, fitting into the deep groove on the scapho-lunar. At the distal edge of the medial side are two large well-marked facets for metacarpal II; a triangular one anteriorly and a trapezoid one posteriorly. Between them is a depression which widens proximally. The facets for the trapezoid are very small. One, barely noticeable, is situated on a slight tubercle between the depression and the posterior facet. The other lies next to the anterior metacarpal II facet. On the lateral side, the facet for the unciform stretches across the anterior end and is continued at the distal edge as an elongated triangle. The distal face is rectangular with a central
depression for articulation with metacarpal III. In the postero-lateral corner is a flat triangular facet articulating with metacarpal IV.

The unciform (fig. 361 and m) is oblong and flattened transversely. The antero-posterior length is a little greater than the proximo-distal length. The anterior surface flares into a broad arrow-head distally. The proximal side is narrow and saddle-shaped, fitting the similar facet on the scapho-lunar. There are two facets for the magnum; a convex one distally and a flat to concave one proximally, which meet forming a narrow bridge. On the lateral side, a large flat facet stretches across the anterior edge to which is applied the cuneiform. The distal face is large, elliptical and concave, and articulates with both metacarpals IV and V.

The metacarpals

Metacarpal I is short and thick (fig. 37a, b and g). The phalangeal articulation is in the form of two flattened condyles, the lateral one of which is extended distally so that the articulation is in a diagonal plane. The proximal trapezium articulation is concave and positioned on the lateral side. The posterior surface is irregular and the anterior surface is convex and smooth.

Metacarpals II (fig. 37f and h) is laterally compressed at the proximal end, tapering to a slender cylinder towards the distal end. The proximal facet for the trapezoid is narrow and concave. On the lateral side there is a proximal concave facet upon which rests metacarpal III. Behind this is a concave facet which articulates with the magnum. The shaft curves outward slightly and shows a well-marked depression on the anterior surface at the proximal extremity.

The proximal articulating face of metacarpal III (fig. 37i) is
triangular, although a small piece is missing. The lateral half of the facet is convex, articulating with the large distal concave facet of the magnum. Metacarpal IV articulates laterally with a large concave facet. The posterior surface is marked by a longitudinal crest where the digital flexor was inserted. The shaft is slender and straight with a slight anterior curvature (fig. 37e).

Metacarpal IV (fig. 37j), articulating with one half of the distal face of the unciform has a smooth rounded proximal surface, but a small piece has broken off. In the antero-medial corner is a low tubercle, fitting on to metacarpal III. On the lateral side there is a deep depression and sharp ridge which locks with metacarpal V.

The posterior side carries a longitudinal crest, which although not as distinct as that on metacarpal III is continued twice the distance. The shaft is straight and slender (fig. 37d).

Metacarpal V articulates with the lateral head of the unciform, but does not reach the cuneiform. The articulating surface is convex (fig. 37k). On the lateral side is a low tubercle forming a small ridge proximally. The shaft is oval in section, with the axial plane directed obliquely. The shaft also has an outward curvature (fig. 37c).

The distal ends of metacarpals II to V have a large spherical condyle, which posteriorly has a marked longitudinal crest. On either side of the condyle is a small tubercle.

The phalanges

The first phalanx of digit I is short, very wide and sturdy (fig. 38a). It has two well marked facets proximally for articulation with the condyles of metacarpal I. The distal end is a rounded condyle to articulate with the terminal phalanx.

The first phalanx of digit V (fig. 38b) is slender and less than
half the length of the metacarpal. The proximal end is expanded into a large, very concave facet for articulation with the metacarpal and there are two condyles distally for the second phalanx. The shaft is sub-cylindrical.

The only preserved second phalanx also belongs to digit V (fig. 38c). It is about two thirds the length of the first phalanx. It is triangular in section, the ventral and medial surfaces flat and concave respectively. The proximal end has two concave facets and the distal end is a single condyle.

Of both right and left specimens, the only third phalanx preserved is that belonging to each first digit (fig. 38d and e). It is very large, compressed laterally and high dorso-ventrally. On the proximal face is a concave facet articulating with the second phalanx, and the distal end is hollow with a central core of bone to support the claw. The ventral surface slopes downward distally.

The sesamoid bones

There are present eight sesamoids belonging to the right manus and two belonging to the left. All, except one, on the right are crescent-shaped, fairly large, and were associated with metacarpals II to V. They would have been positioned at each of the digital joints on the posterior surface. No. 24 was found attached to the distal end of the first phalanx of digit I. It is small and rounded and a similar one (No. 34) was associated with the left first digit.

A larger rounded sesamoid (No. 31) was found closely applied to the left trapezium. This is the radial sesamoid, missing on the right, and which almost forms another element in the distal row of carpals.

Fig. 38f is a reconstruction of the right manus, with the preserved bones in their correct positions.
Specimen 16192M

This specimen in Breccia Block D was found close to Breccia Blocks A and B. It comprises the distal end of the humerus and proximal ends of radius and ulna of the left elbow joint (fig. 40). The external side of the articulation has been sheared off. The epiphyses of the humerus and radius are well marked, indicating that the animal was immature at the time of death. It was, nevertheless, a fairly large carnivore, as the bones are about the same size as an adult leopard's.

The distal end of the humerus shows signs of a slight curvature. There is no entepicondylar foramen, and no supra-trochlea foramen. The olecranon fossa is high, narrow and deep, and implies that the olecranon, which is not preserved, was well developed. Most of the external condyle has been sheared off, but the shaft above the trochlea becomes very narrow in the transverse direction.

The radius has been displaced slightly from its external position, and lies directly over the ulna. Its proximal end is very wide and flat, but it tapers sharply. The olecranon process of the ulna has been broken off, although the internal side of the sigmoid notch is preserved. The proximal end of the shaft is much slimmer than the radius. It is very flat in the transverse plane, and its height is also small. There is only a slight increase in width towards the olecranon, but the full extent of this increase is not known. The ulna has a much more fragile appearance than the radius.

No muscle attachment areas could be observed, although these were most probably present in the adult.

Specimens 16193M to 16195M

These three specimens are vertebral epiphyses, and were all associated with the previous specimen. They almost certainly belonged to the same
individual. Each is a circular to oval disc, concave on one side and convex on the other (fig. 41b). The convex sides are coated in matrix, which indicates the presence of cartilage, while the concave sides are smooth. Since these epiphyses were not yet fused to the centra the animal must have been immature at the time of death. They are of a size that would correspond to sp. 16192M.

Rodent remains

Also associated with the above material were several rodent bones. These are: a thoracic, and what looks like a lumbar vertebra, a radius, a second phalanx and some indeterminable fragments, among them what might be part of a pelvis.

All of this material was associated in two small breccia blocks, numbered D and E. (figs. 39 and 41a).

3.5 THE IDENTITY OF THE SPECIMENS

Specimen M256

The proportions of sp. M256 are those of a large felid. When compared with a modern felid skull, certain features were noted to be almost identical. The relative size and curvature of the orbits is similar; there is a marked depression at the junction between frontal and nasal bones; the nasals are well developed and arched, with a broad junction with the frontals; there is no sign of the nasal processes of the premaxillae meeting the frontals on either side. In the absence of teeth, the large posterior palatine depression on the palate indicates a carnivorous animal, and while size eliminates all Canidae, the proportions of the skull are quite different from the Hyaenidae.

When measurements of sp. M256 were compared with those of a modern
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Name of thesis Some New machaerodonts from Makapansgat limeworks  1973

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