

Chapter 2

Paleontological Localities on the Eyasi Plateau, Including Laetoli

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Abstract Sixty paleontological localities are recorded at Laetoli and other areas on the Eyasi Plateau. These include several new localities at Laetoli, and many newly designated localities in the Kakesio and Esere-Noiti areas to the south and southwest of Laetoli. Descriptions of the locations, stratigraphic context and paleontological significance of each locality are presented. The Laetoli localities have produced a rich assemblage of fossils from the Pliocene-aged Upper Laetolil Beds and Upper Ndolanya Beds. The most productive localities are Localities 2, 10E and 18, which have each yielded more than 2,000 fossil mammals since 1974. In addition, smaller samples of fossil vertebrates and stone artifacts have been recovered from the Pleistocene Olpiro and Ngaloba Beds. Fossil hominins are presently known only from localities at Laetoli. The Upper Laetolil Beds have yielded the remains of *Australopithecus afarensis*, and tracks of fossilized footprints of hominins, presumably of *A. afarensis*, are known from Locality 8 (Footprint Site G). Three new specimens of *A. afarensis* have been recovered from Laetoli since 1998, and the provenance of these specimens is described here. In addition, fossil hominin specimens have been recovered from the Upper Ndolanya Beds for the first time. A cranium of an archaic form of *Homo sapiens* is known from the Upper Ngaloba Beds at Locality 2. Localities in the Kakesio area and the Esere-Noiti area have yielded relatively small, but important, collections of fossil vertebrates, invertebrates and plants from the Lower Laetolil Beds. No hominins have yet been recovered from this stratigraphic unit, although it is possible that they may be discovered in the future with more intensive collecting and surveying.

Keywords Garusi • Gadjingero • Emboremony • Kakesio • Esere • Noiti • Laetolil Beds • Ndolanya Beds • Ngaloba Beds • Hominins • Fossil vertebrates

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Introduction

The Laetolil Beds are widely distributed across the Eyasi Plateau on the northern side of Lake Eyasi, covering an area of more than 1,000 km² (Fig. 2.1). They extend as far south as Esere, Olpiro and Sinoni, west beyond the village of Kakesio, north as far as Lake Ndutu, and east just beyond Endulen (Fig. 2.2). The extinct volcanic centers of Lemagurut, Satiman, Oldeani, and Ngorongoro are located to the east, and these represent the potential sources of the tephra and lavas found in the region. The oldest of the volcanic centers, Satiman (previously Sadiman), has been inferred to be the most likely source of the Laetolil Beds (Hay 1987; Mollel et al. 2011).

During the Pliocene, volcanic ashes were blown southwest from the Satiman highlands in the direction of the prevailing winds today, and these settled on the relatively flat terrain of the southern Serengeti. Laetolil tuffs can be traced more than 50 km away in this direction (cognate sediments deposited in lake beds in the Manonga Valley, more than 150 km to the southwest, can be inferred to be derived from the same volcanic source; Mutakyahwa 1997; Mollel et al. 2011). As a consequence, the Laetolil Beds are thickest towards the east, closest to their source in the volcanic highlands, and they become thinner to the southwest. The richly fossiliferous Upper Laetolil Beds and Upper Ndolanya Beds are best exposed in the Laetoli area. West and south of Laetoli, the Laetolil Beds are extensively exposed, but the Upper Laetolil Beds have largely been lost through erosion, and outcrops of the underlying Lower Laetolil Beds predominate. West, beyond the village of Kakesio, and along the margin of the Eyasi Rift escarpment, the Laetolil Beds have been eroded away, presumably washed into the Eyasi basin, to expose the underlying Precambrian basement rocks.

Paleontological localities on the Eyasi Plateau occur in three main geographical areas: Laetoli, Kakesio, and Esere-Noiti (Fig. 2.2). The most productive localities are those associated with the Upper Laetolil Beds and Upper Ndolanya Beds at Laetoli, and this is where previous expeditions have

Fig. 2.1 Map of Tanzania showing the Eyasi Plateau-Laetoli research area north of Lake Eyasi. Detail of the research area is shown in Fig. 2.2

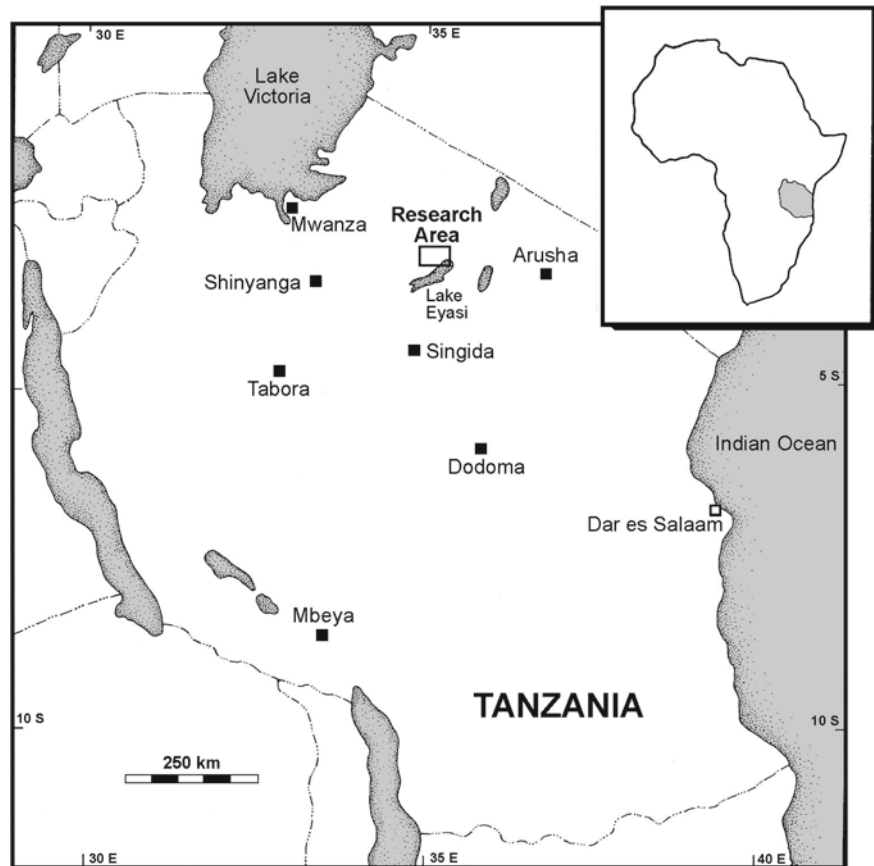


Fig. 2.2 A sketch map of the Eyasi Plateau showing the major rivers and villages, as well as the three main paleontological research areas: Laetoli, Kakesio and Esere-Noiti (see Figs. 2.3–2.5 for detail of insets)

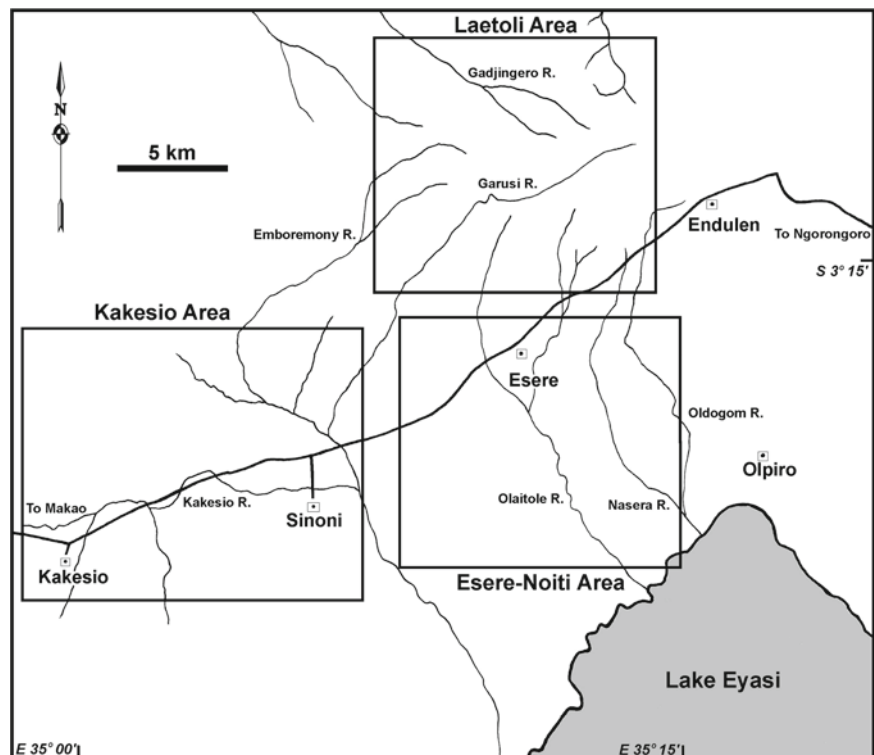
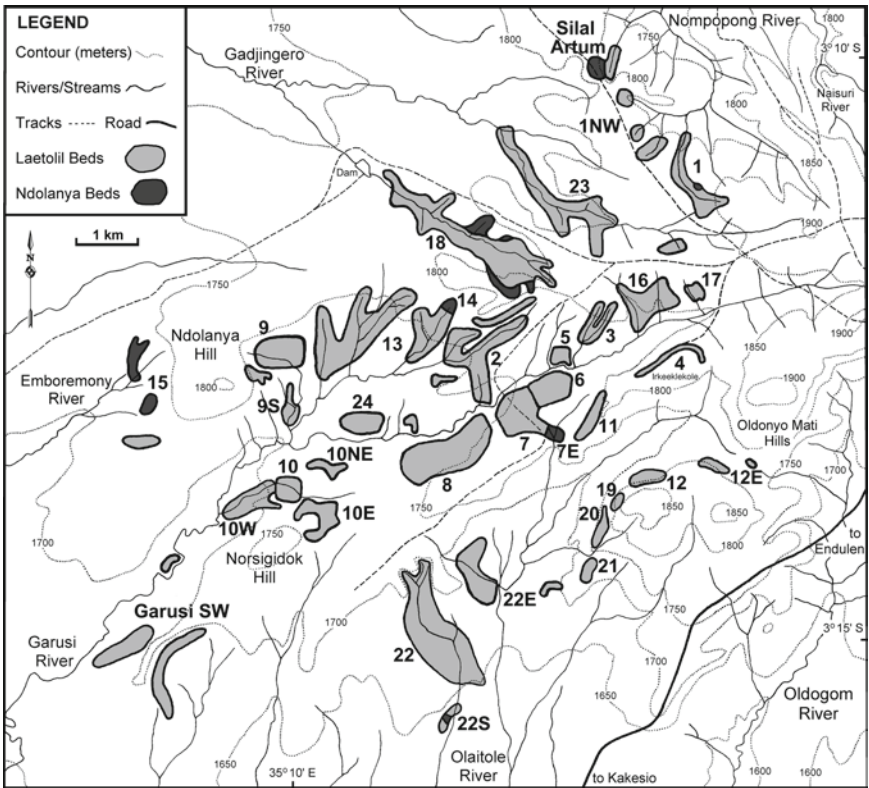


Fig. 2.3 Map of the Laetoli area showing the main outcrops of the Upper Laetoli and Upper Ndolanya Beds and the paleontological collecting localities



concentrated their efforts, where the bulk of the vertebrate fossils have been recovered, including all of the fossil hominins, and where the fossil footprint sites are located (Leakey 1987a, b, c). The localities at Laetoli cover an area of about 100 km², with fossiliferous outcrops occurring along the Garusi, Olaitole, Gadjingero and Nompopong River valleys (Fig. 2.3). Extensive outcrops of Lower Laetoli Beds occur in the Kakesio and Esere-Noiti areas, but fossils are much more scanty than at Laetoli, and localities in these areas have so far not yielded any fossil hominins.

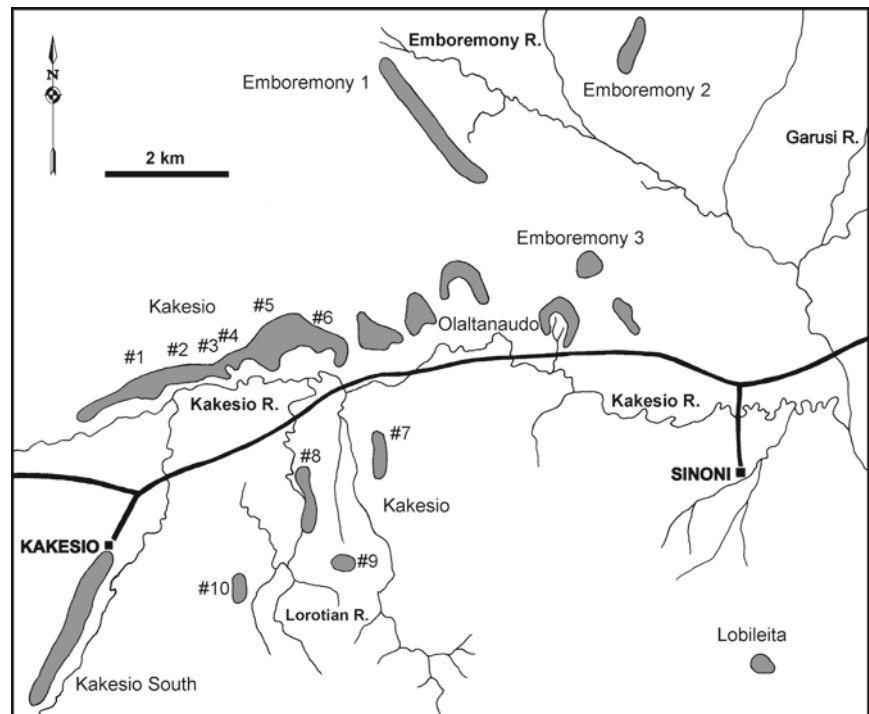
Paleontological occurrences at Laetoli were first recorded in 1935. L.S.B. Leakey and other members of the East African Archaeological Expedition (i.e., Peter Kent, Stanhope White, G.T. Bell and Mary Leakey) spent 10 days at Laetoli and localities to the south (Leakey 1935, 1987a; Kent 1941). They made a small collection of fossil vertebrates (including a hominin lower canine) and terrestrial gastropods from exposures along the Garusi valley, as well as at Endulele (probably Esere) and Ngai (probably Ngaloba), which are housed in the Natural History Museum, London. The first major paleontological expedition to Laetoli was directed by Kohl Larsen in 1939. Although Kohl-Larsen did not designate specific collecting localities or apparently keep a field catalogue, he did inscribe on individual specimens the valleys from which they were recovered (i.e., Garussi, Deturi, Vogelfluss, Gadjingero, Marambu and Lemugrut Korongo). By using published sketch maps it is possible to determine

Table 2.1 Place names and collecting locality used by Kohl-Larsen (Dietrich 1942; Kohl-Larsen 1943; Protsch 1981) and Kent (1941), and the currently recognized names and designations (see Figs. 2.2–2.5)

Kohl-Larsen locations	Kent locations	Current place name (Localities)
Deturi	Eilippi River	Olaitole River (Locs. 12, 12E, 19, 20, 21, 22, 22E)
Gadjingero	Lgarja	Gadjingero River (Loc. 18)
Garussi	Vogel River	Garusi River
Lanaimuria	Laetoli Springs	Esere Spring
Lemagrut Korongo	Ngarusi Hill	Norsigidok Hill
Lubiro		Lemagrut Korongo
Marambu	Oldoway Branch Gorge	Olpiro
	Ndulem Hills	Nompopong River (Locs. 1, 1NW)
Ndulemi		Ndonyamati Hills or Oldonyo Mati Hills
Oldogom		Endulen
		Oldogom River (Oleisusu)
Olduwai	Naibadad	Naibadaad
Speer Berg	Speer Mountain	Eseketeti
Vogelfluss	Vogel River	Garusi River

the general location of most of the 1939 finds and match them with currently recognized locations (Dietrich 1942; Kohl-Larsen 1943; Protsch 1981; see Table 2.1). Additional

Fig. 2.4 Map of the Kakesio area showing the main outcrops of the Lower Laetolil Beds and the paleontological collecting localities (grey shaded areas)



brief excursions to Laetoli were made by the Leakeys and their co-workers in 1959 and 1964 (Leakey 1987a).

Mary Leakey directed full-scale paleontological and geological investigations at Laetoli between 1974 and 1982. During this phase of research the primary focus of attention was on Laetoli, where the bulk of the fossils were collected, but small supplementary collections were made at Kakesio (Leakey and Harris 1987; Harris 1987). Leakey's team designated the various exposures at Laetoli as separate collecting localities, using topographic features and vegetation as natural boundaries. A total of 28 collecting localities and sub-localities were recorded, numbered from 1 to 23 (Leakey 1987a). Most of these localities produced fossils from the Upper Laetolil Beds, while Locs. 7E, 14 and 18 yielded abundant fossils from the Upper Ndolanya Beds (Leakey 1987a).

The Laetoli collecting localities identified by Mary Leakey have been used by subsequent researchers, including teams led by Terry Harrison from 1998 to 2005. However, several new localities have been identified (i.e., Locs. 1NW, 10NE, 22E, 22S, 24, Garusi SW, Silal Artum), bringing the total number of collecting localities at Laetoli to 35. The most important new localities and occurrences are those associated with the Upper Ndolanya Beds (i.e., Locs. 15, 22S and Silal Artum), which have, for the first time, yielded fossil hominins from this stratigraphic unit (Fig. 2.3). In addition, systematic regional surveys on the Eyasi Plateau to the southwest and south of Laetoli have led to the recognition of a number of newly recognized fossil-bearing localities (25 in total), mostly exposing outcrops of the Lower Laetolil Beds. These include localities at Emboremony, Engesha, Esere,

Kakesio, Kakesio South, Lobileita, Olaltanaudo, and Noiti (Figs. 2.4 and 2.5).

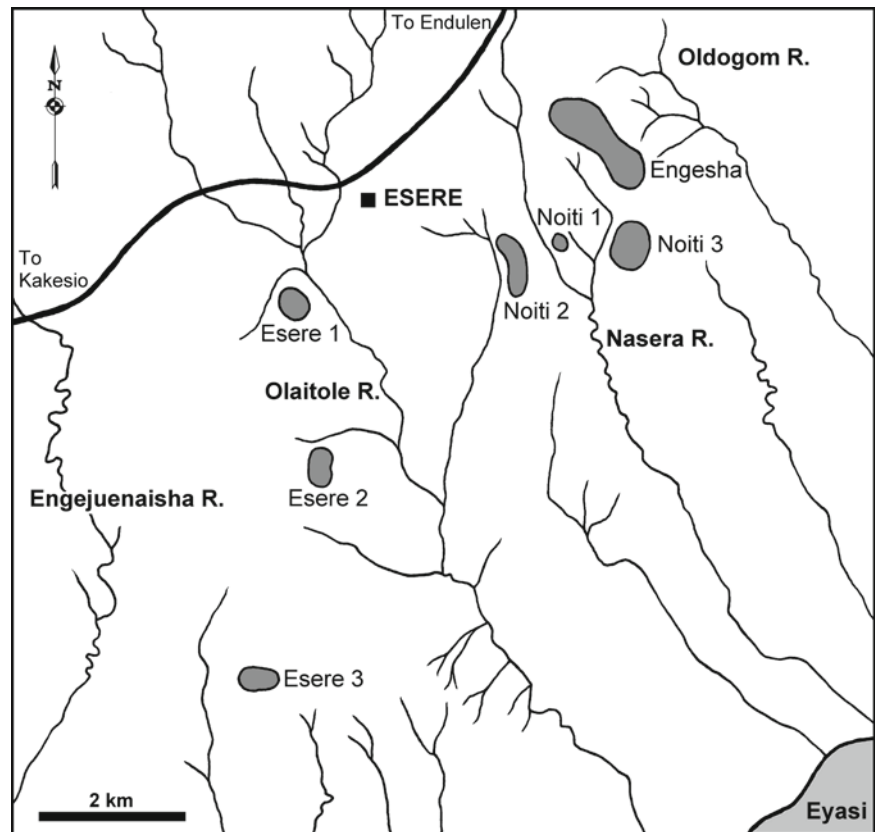
The aim of this chapter is to briefly describe the location, stratigraphic context, and paleontological significance of the 60 currently recognized localities at Laetoli and elsewhere on the Eyasi Plateau. Particular attention is given to the provenance of the five new hominin specimens recovered since 1998. The main stratigraphic units and horizons producing the fossils at each of these collecting localities are summarized in Table 2.2. Ditchfield and Harrison (2011) provide additional detailed information on the geology of these localities.

Paleontological Localities at Laetoli

Locality 1

This is the easternmost locality at Laetoli (Fig. 2.3). The main fossiliferous exposures of the Upper Laetolil Beds are located at the head of the Nompopong River, a seasonal river course about 3.5 km to the northeast of the Garusi River. The river drains northwards into the Norkuman River, and eventually into the Olduvai Side Gorge. In a series of short steps, the river exposes a ~60 m section of the Upper Laetolil Beds, from the Yellow Marker Tuff to below Tuff 1, as well as more than 60 m of the upper part of the Lower Laetolil Beds. The Upper Laetolil Beds can be traced along the river for a distance of 2.5 km, and

Fig. 2.5 Map of the Esere-Noiti area showing the main outcrops of the Lower Laetolil Beds and the paleontological collecting localities (grey shaded areas)



they represent the most complete and thickest section of these beds at Laetoli. According to Kohl-Larsen's sketch map of the region it is possible to deduce that Loc. 1 is the equivalent of Kohl-Larsen's Marambu (Kohl-Larsen 1943).

Almost all of the fossils from Loc. 1 have been recovered from between Tuffs 6 and just above Tuff 8, mostly from the main gully near the head of the river (Figs. 2.6 and 2.7). It is quite a productive locality, and over 800 fossil mammals have been recovered, including two hominins (L.H. 1 and L.H. 15) collected by Mary Leakey's expeditions (Leakey 1987b). The overlying Yellow Marker Tuff contains abundant fossil wood and root casts. Further downstream, fossils are sparsely represented in the Upper Laetolil Beds, and have not yet been recovered from the Lower Laetolil Beds. A small outcrop of Upper Ndolanya Beds, located in a narrow fault on the eastern side of the gully, has also produced fossils. Overlying the Yellow Marker Tuff is a thick series of Ngaloba Beds, which occasionally yield Pleistocene fossils and stone tools.

Locality 1NW

A series of small, discrete exposures on the western flanks of the Nomppong River valley, located at the origins of several small tributaries and gullies that drain into the main river

course. Short sections (less than 10 m) of the Upper Laetolil Beds above and below Tuff 7 are exposed at the locality. The area is heavily vegetated, and fossils are scarce.

Locality 2

A large and complex site on the northern flank of the Garusi River, which extends about 1.5 km E-W and 2 km N-S. The main exposures are associated with seasonal tributaries of the Garusi River. The southern and central areas of the locality are heavily vegetated with bush and tree cover. Two reservoirs were constructed at the locality in 2001, and these now form the western margin of the locality (Fig. 2.8). The locality can be informally subdivided into three main collecting areas: the northwestern arm, the northeastern arm, and the southern arm (Fig. 2.9). Mary Leakey's camp (1976–1981) was located at the junction between the southern and northeastern arms (Leakey 1987a). The most productive areas for fossils are the northwestern and southern arms. Fossils are mainly derived from the Upper Laetolil Beds between Tuffs 5 and 7, including numerous fossil vertebrates, as well as termitaries, insects and abundant seeds. The locality is the second most productive after Loc. 10E, and has yielded over 2,700 fossil mammals. A single hominin specimen, an isolated P_3 (L.H. 25), was found in 1978 from just

Table 2.2 Stratigraphic position of fossil-bearing localities at Laetoli and other sites on the Eyasi Plateau

Locality	Stratigraphic Unit	Main fossiliferous horizons	Comments
1	Upper Laetolil Beds	Between Tuffs 6 and just above Tuff 8	
	Upper Ndolanya Beds		Few fossils
	Olpiro Beds		Few fossils
1NW	Upper Laetolil Beds	Between Tuffs 6 and 8	
2	Upper Laetolil Beds	Between Tuffs 5 and 7	
	Upper Ngaloba Beds		Few fossils and stone tools
3	Upper Laetolil Beds	Between Tuffs 7 and 8	Few fossils between Tuffs 4 and 6
4	Upper Laetolil Beds	Between Tuffs 6 and 8	
5	Upper Laetolil Beds	Between Tuffs 3 and 5	
	Lower Ngaloba Beds		Few fossils
6	Upper Laetolil Beds	Between Tuffs 5 and 7	
7	Upper Laetolil Beds	Between Tuffs 5 and 8	
7E	Upper Ndolanya Beds		
8	Upper Laetolil Beds	Between Tuffs 5 and 7	Few fossils between 7 and just above Tuff 8
9	Upper Laetolil Beds	Between Tuffs 5 and 7	Few between Tuffs 7 and 8
	Upper Ndolanya Beds		Few fossils
9S	Upper Laetolil Beds	Between Tuffs 2 and just below Tuff 1	
10	Upper Laetolil Beds	Between Tuffs 3 and just below Tuff 1	
10E	Upper Laetolil Beds	Between Tuffs 5 and 7	Few fossils between Tuffs 7 and 8
10W	Upper Laetolil Beds	Between Tuffs 3 and just below Tuff 1	
10NE	Upper Laetolil Beds	Uncertain	Few fossils
11	Upper Laetolil Beds	Between Tuffs 7 and 8	
12	Upper Laetolil Beds	Between Tuffs 5 and 8	
12E	Upper Laetolil Beds	Between Tuffs 5 and 7	
13	Upper Laetolil Beds	Between Tuffs 5 and 8	Few fossils between Tuffs 3 and 5
	Upper Ndolanya Beds		Few fossils
	?Ngaloba Beds		Few fossils
14	Upper Ndolanya Beds		
15	Upper Laetolil Beds	Between Tuffs 5 and 7	
	Upper Ndolanya Beds		
16	Upper Laetolil Beds	Between Tuff 7 and Yellow Marker Tuff	
	Olpiro Beds		Fossils and stone tools
17	Upper Laetolil Beds	Between Tuff 7 and Yellow Marker Tuff	
18	Upper Ndolanya Beds		
19	Upper Laetolil Beds	Between Tuffs 5 and 8	
20	Upper Laetolil Beds	Between Tuffs 6 and 8	
21	Upper Laetolil Beds	Between Tuffs 5 and 7	
22	Upper Laetolil Beds	Between Tuffs 5 and 7	Few fossils between Tuffs 1 and 2
22E	Upper Laetolil Beds	Between Tuffs 5 and 7	Few fossils between Tuffs 2 and 4
	Upper Ndolanya Beds		Few fossils
22S	Upper Laetolil Beds	Between Tuffs 1 and 3	Few fossils
	Upper Ndolanya Beds		Restricted to Nenguruk Hill
23	Upper Laetolil Beds	Between Tuffs 7 and 8	Few fossils
	Lower Ngaloba Beds		Fossils in association with stone tools
24	Upper Laetolil Beds	Between Tuffs 6 and 8	Few fossils
Emboremony 1–3	Lower Laetolil Beds		
	?Ngaloba Beds		
Engesha	Lower Laetolil Beds		
Esere 1–3	Lower Laetolil Beds		
Garusi SW	Laetolil Beds	Uncertain	
Kakesio 1–10	Lower Laetolil Beds		
Kakesio South	Lower Laetolil Beds		
Lobileita	Lower Laetolil Beds		
Olaltanaudo	Lower Laetolil Beds		
Oleisusu	Upper Laetolil Beds	Between Tuff 7 and Yellow Marker Tuff	
Ndoroto	Upper Laetolil Beds	Between Tuff 8 and Yellow Marker Tuff	
Noiti 1–3	Lower Laetolil Beds		Fossil vertebrates from Noiti 3 only
Silal Artum	Upper Ndolanya Beds		

Fig. 2.6 Locality 1. View (west) of main exposure of Upper Laetolil Beds at the head of the Nompogong River valley. Marker Tuff 8 and the Yellow Marker Tuff are highlighted. The concrete pedestal (indicated) marks the location of the first fossil hominin find (L.H. 1) made by Mary Leakey's expedition in 1974

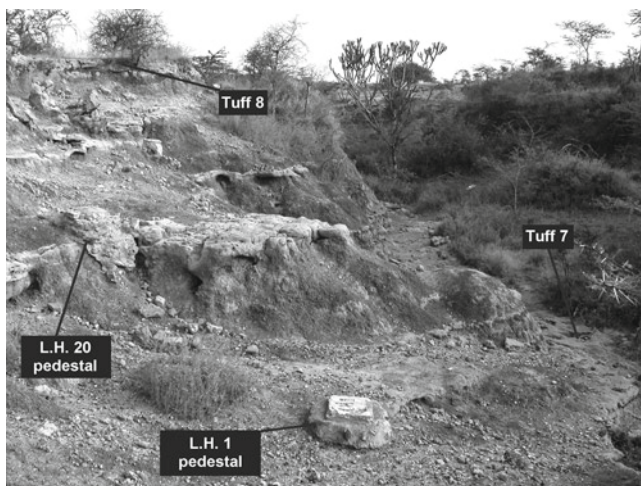


Fig. 2.7 Locality 1. View (north) of main exposure of Upper Laetolil Beds at the head of the Nompogong River valley. The concrete pedestal marks the location of the first fossil hominin find (L.H. 1) made by Mary Leakey's expedition in 1974. It is located 1.2 m above Tuff 7. L.H. 20 was initially believed to be a hominin incisor, but was subsequently recognized by Tim White as that of a Cercopithecidae

above Tuff 6 (Leakey 1987b). The footprint Tuff, Tuff 7, is exposed along the northwestern margin and southern margin of the locality. Footprint sites O and P are located at the southern end of the locality (Leakey 1987c).

A poorly exposed outcrop of the Laetolil Beds above Tuff 7 is located just north of the main exposure at the foot of Ngirerati Hill, and has yielded few fossils. This horizon is overlain by a thick series of Ndolanya Beds and Naibadad Beds. The Late Pleistocene Upper Ngaloba Beds in the



Fig. 2.8 View (south) of the Garusi Valley showing the location of Locality 2 (northeastern and northwestern arms)

southern part of the locality, close to the Garusi River, have yielded Middle Stone Age tools in association with faunal remains, including a relatively complete cranium of *Homo sapiens* (L.H. 18) (Day et al. 1980; Magori and Day 1983). Mary Leakey (1987b: 116) incorrectly lists the latter specimen as coming from Loc. 25, which is presumably a typographic error for Loc. 2S.

Locality 3

This locality is situated about 1 km east of Loc. 2, on the northern side of the Garusi valley. Outcrops of the Upper Laetolil Beds extend approximately 1 km along a gully running NE-SW that drains into the Garusi River (Fig. 2.10).

Fig. 2.9 Locality 2. View (north) of southern arm



Fig. 2.10 Locality 3. View (north) of main exposures. Norsigidok Hill is visible in the background



A second tributary of the Garusi, just to the east of the main gully, also exposes Upper Laetolil Beds, but these are poorly fossiliferous. Most of the fossils from this locality are derived from between Tuffs 7 and 8, but a few specimens have been recovered from lower in the stratigraphic sequence between Tuffs 4 and 6. Mary Leakey's expedition recovered a single fossil hominin from above Tuff 7, L.H. 2, a partial mandible of a juvenile individual (Leakey 1987b).

Also of interest is a fossiliferous horizon 60–70 cm above Tuff 7, consisting of a calcareous pale brown clay about 17 cm thick, which is rich in fossil dung, twigs, seeds, and insects (see Bamford 2011a; Krell and Schawaller 2011; Kitching and Sadler 2011; Harrison 2011a; Figs. 2.11 and 2.12). The tuffaceous sediments, derived from the surrounding volcanic ashes, were accumulated in a shallow pond, along with a variety of organic debris. The debris was probably washed into the pond from the surrounding land surface by seasonal run-off or accumulated in a shallow depression that was subsequently flooded and inundated with sediment. It may have been a small waterhole that flooded seasonally. Based on the extent of the exposed sediments the pond was at least 40 m wide (Fig. 2.13). After compaction and consolidation of the



Fig. 2.11 Locality 3. The clay horizon yielding fossil plants, coprolites and insects occurs just below the hard tuff running left to right across the center of the picture

deposits, the organic materials decomposed, leaving behind a cavity or void in the sediment. Because the sediments are fine-grained, the void produced a detailed mold of the exter-

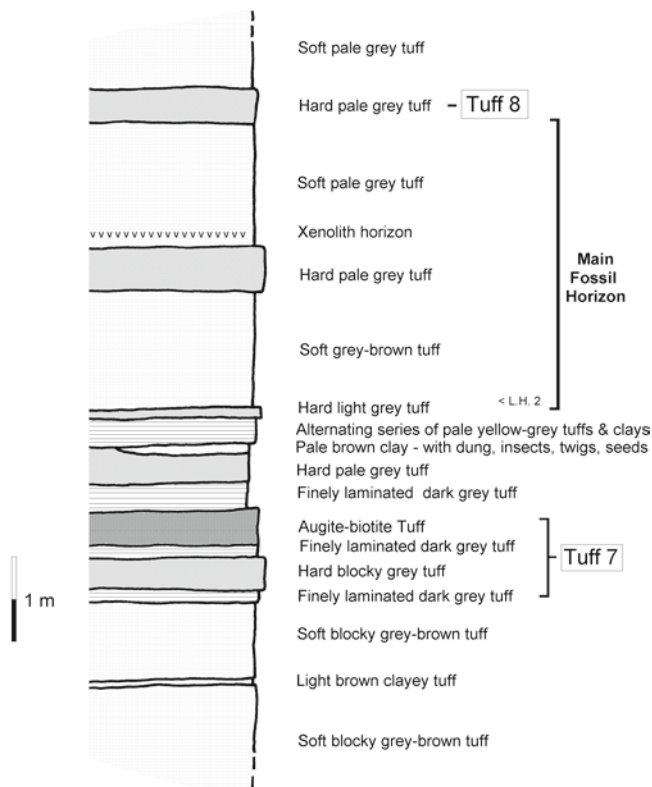


Fig. 2.12 Locality 3. Part of the stratigraphic section that has yielded fossil remains. Most of the vertebrate fossils are derived from the pale grey and grey-brown tuffs below Tuff 8. The stratigraphic position of the L.H. 2 pedestal is indicated. The coprolites, plant material and fossil insects are derived from a pale brown clay about 60–70 cm above Tuff 7

nal structure of the debris. This was subsequently filled with calcite in solution derived from the calcium carbonate rich carbonatite tuffs of the Laetolil Beds. This produced a natural cast of the organic debris, resulting in beautifully preserved fossils (Fig. 2.14).

Locality 4

A series of exposures forming a narrow strip around the base of the northern side of Irkeeklekole Hill, located about 400 m south of the head of the Garusi River (Fig. 2.15). The Kohl-Larsen (1938–1939) and Harrison (1998–2005) camps were both established near this locality. The exposures extend for a length of about 1.3 km, but those along the eastern side of the locality are the most extensive and have produced the majority of fossils. Fossils are not common, and they tend to be fragmentary. All are derived from the Upper Laetolil Beds between Tuffs 6 and 8. The Footprint Tuff (Tuff 7) is exposed along the eastern side of the locality, with a few isolated prints, and the base of the tuff preserves an abundance of calcified plant material, including leaves, twigs (up to 4 cm in diameter) and seeds. Fossil thorns and impressions of compound microphyllous leaves, similar to those of *Acacia*, have been recovered. Higher up the sequence, the poorly exposed Yellow Marker Tuff contains an abundance of calcareous root cast, up to 10 cm in diameter.

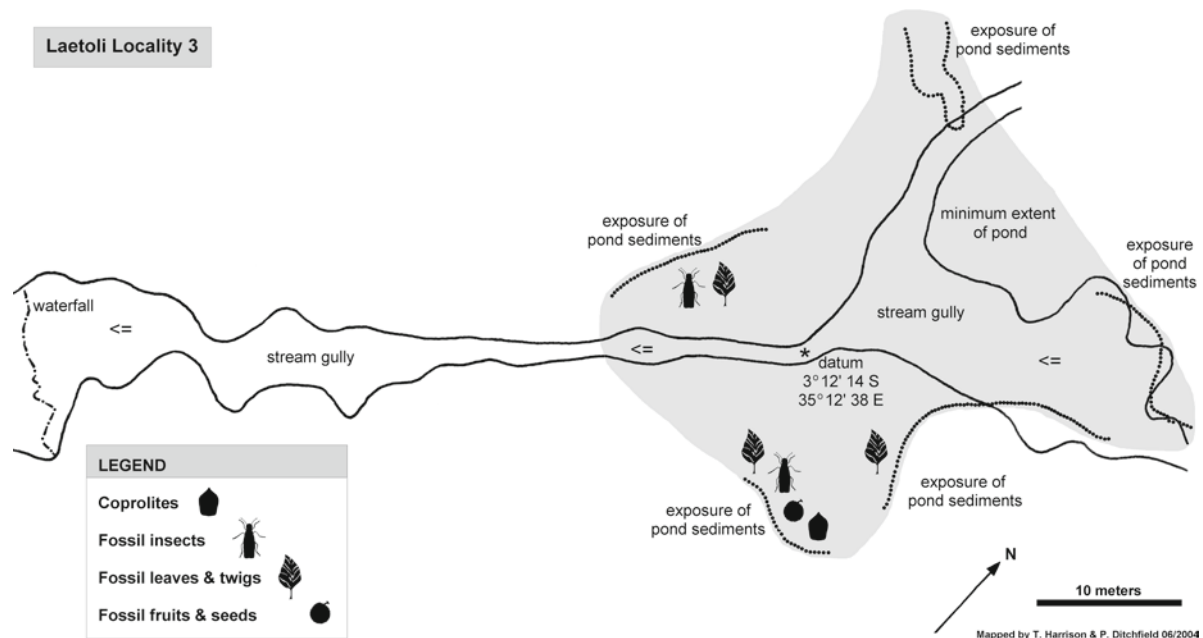


Fig. 2.13 Locality 3. Sketch map of the distribution of the clay horizon that has yielded fossil plants, insects and coprolites, as well as the reconstructed extent (grey shading) of the pond or waterhole

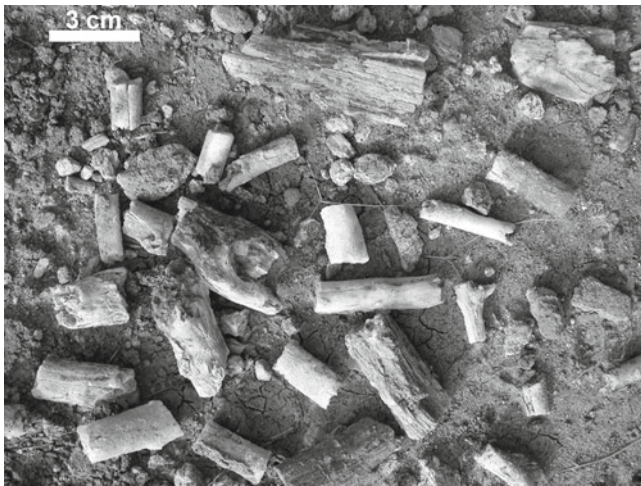


Fig. 2.14 Locality 3. Fragments of fossil wood and seeds that have eroded out of the clay horizon onto the surface of the deposits

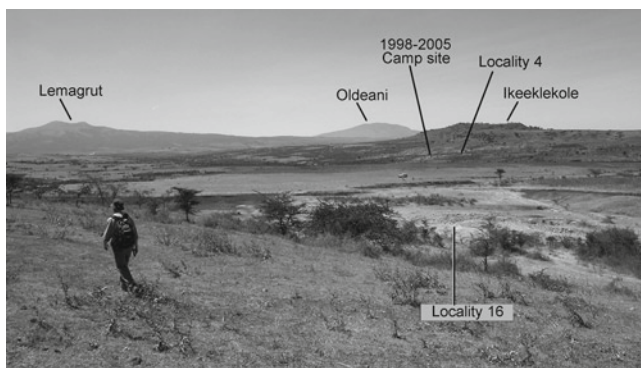


Fig. 2.15 Locality 4. View (south) across the Garusi River valley showing the location of Localities 4 and 16, and other major geographical landmarks

Locality 5

This is a relatively small locality, surrounded by thick vegetation (Fig. 2.16). It is located on the north side of the Garusi valley, very close to the river, opposite Loc. 6. The locality is quite richly fossiliferous; small mammals are especially well-represented. The fossils are primarily derived from the Upper Laetolil Beds between Tuffs 3 and 5. Tuff 3 is extensively exposed, and it preserves numerous footprints, especially those of guineafowl and small mammals. Two fossil hominins have been recovered (L.H. 7 and L.H. 12) (Leakey 1987b). A small hillock to the eastern side of the locality is capped by a thin remnant of Ngaloa Beds. The fossils from this horizon are found mixed with those from the Laetoli at the foot of the hillock, but they can be readily separated in most cases based on coloration and degree of mineralization.



Fig. 2.16 Locality 5. View of main exposures between Tuffs 3 and 5

Locality 6

This locality is situated on the southern side of the Garusi Valley, close to the main river course, about 1 km from the western margin of Loc. 4. The fossils are derived from the Upper Laetolil Beds between Tuffs 5 and 7. The site is relatively extensive, with good exposures, and is one of the most productive localities. The combined collections of fossil mammals recovered since 1974 exceed 1,300 specimens. Two isolated molars of fossil hominins were recovered by Mary Leakey's team (L.H. 16 and L.H. 26) in 1976 and 1978 respectively (Leakey 1987b), and a hominin patella (EP 2038/03) was recovered in 2003 (Harrison 2011b). The latter specimen was found in a small side gully (coordinates: 3° 12' 57" S, 35° 12' 12" E) 30 cm below Tuff 6.

Locality 7

An extensive exposure of Laetolil Beds on the southern side of the Garusi River, located just to the west and south of Loc. 6 and contiguous with it (Fig. 2.17). The motor track that runs through the Laetoli area crosses at a ford onto the southern side of the Garusi Valley and passes through the locality. The main part of the locality exposes the Upper Laetolil Beds between Tuffs 5 and 7. Fossil vertebrates are found throughout the section, but are mainly derived from a 5 m section above and below Tuff 6. On the southeastern side of the locality, near Loc. 7E, there is a series of low cliffs and hillocks, 2–4 m high, which expose a fossiliferous section of the Upper Laetolil Beds above Tuff 7, including Tuff 8 and the Yellow Marker Tuff. Several hominins have been recovered from this locality, including L.H. 3, L.H. 4 (the lectotype of *Australopithecus afarensis*), L.H. 6 and L.H. 30 (Leakey 1987b). There are several good exposures of the Footprint Tuff, including Footprint Sites A, B, and C (Leakey 1987c).



Fig. 2.17 Locality 7. View of main exposures

Locality 7E

This is a small exposure of Upper Ndolanya Beds, extending about 50 m, located just to the southeast of Loc. 7. The Upper Ndolanya Beds are deposited in a minor fault that can be seen as a break in the NE-SW trending ridge that forms the southern boundary of the locality. Due to the faulting, the relatively soft and easily weathered Ndolanya Beds are preserved here, whereas at most other localities these tuffs have been rapidly denuded from the surface of the Laetolil Beds. It is very fossiliferous, having yielded a high percentage of post-cranial remains of medium to large-sized bovids, including associated elements and partial skeletons (Leakey 1987a).

Locality 8

This is an extensive locality with good exposures of the Upper Laetolil Beds between Tuffs 4 and the Yellow marker Tuff (Fig. 2.18). It is located on the southern side of the Garusi River, just west of Loc. 7, being separated from it by a low grassy ridge. The western (main) exposures consist of a large open area with sparse tree cover, consisting of a series of low gullies. The eastern exposures are relatively flat, with little topographic relief, and are quite densely vegetated, especially near the Garusi. Locality 8 is one of the most productive localities, with more than 1,800 fossil mammals having been recovered. Most fossils, including the hominins (L.H. 5/27/28, L.H. 13, and L.H. 19), are derived from horizons between Tuffs 5 and 7, but some fossils have also been recovered from between Tuff 7 and just above Tuff 8 (Leakey 1987b). One of the hominin specimens, L.H. 29, a weathered mandibular fragment, was found in 1979 on the surface in the lower part of the sequence. The specimen was assumed to be Pleistocene in age and provisionally attributed to *Homo cf. H. erectus* (Leakey 1987b). However, further com-



Fig. 2.18 Locality 8. View of main exposures between Tuffs 6 and 7. The L.H. 5 pedestal is visible center right



Fig. 2.19 Locality 8. View (south) of footprint site G, which was covered in 1996 to conserve the hominin tracks

parisons indicate that the specimen is more appropriately attributed to *A. afarensis* (Harrison 2011b). The hominin trail of footprints (Footprint Site G) was excavated at the locality in 1978 and 1979 (Leakey 1987c), and was subsequently covered to conserve the prints in 1996 (Fig. 2.19). Musiba (1999) and Musiba et al. (2007) have conducted a detailed taphonomic and paleoecological investigation at this locality, as well as at Loc. 9.

Locality 9

Locality 9 is located on the northern flank of the Garusi River, East of Ndolanya Hill, and just west of Loc. 13, from which it is separated by a flat grassy area. The locality is quite extensive, with well-exposed Upper Laetolil Beds between Tuffs 5 and 7 (Fig. 2.20). There is little topographic relief, and the beds slope gently towards the Garusi. These exposures have yielded the majority of the vertebrate fossils. Large termitaria



Fig. 2.20 Locality 9. View (northwest) of main exposures of Upper Laetolil Beds. Hard dark grey tuff in the foreground is Tuff 6. Ndolanya Hill is in the background

are also common above and below Tuff 6 (Darlington 2011). Some fossils occur between Tuffs 7 and 8, but they are not common. Along the heavily vegetated ridge that forms the northern extent of the locality there are exposures of the Upper Ndolanya and Naibadad Beds, but only the former appear to be fossiliferous. In the southern part of the locality, exposures are poor because of heavy vegetation cover, but the Upper Laetolil Beds do extend down to below Tuff 3. The lower part of the section below Tuff 5 has produced few fossils. Calcified plant material is associated with the base of Tuff 3, and several small ovoid termitaries have been observed in situ below Tuff 3. An isolated upper molar of a hominin (L.H. 17) was recovered as a surface find in 1976 (Leakey 1987b). An extensive section of the Footprint Tuff is exposed and is designated as Footprint Site K (Leakey 1987c).

Locality 9S

This locality is situated on the northern side of the Garusi, about 400 m south of Loc. 9, along a river gully that drains into the Garusi River (Fig. 2.21). The boundary between Loc. 9 and Loc. 9S is a 5 m high waterfall. Loc 9S consists of a series of gullies that trend N-S, with steep sided cliffs up to 5 m in height. The surrounding area consists of dense bush and woodland. The section exposes a series of tuffs from the lower part of the Upper Laetolil Beds below Tuff 2. The base of the section consists of finely laminated waterlain tuffaceous beds. Fossil vertebrates are quite common, as are relatively large termitaries (70–100 cm in diameter). Bonnefille and Riollot (1987) analyzed fossil pollen samples obtained from clay horizons 2 m below Tuff 1 and from a termitary 3 m below Tuff 1. Attempts to resample the clay horizons below Tuff 1 have failed to produce definitive fossil pollen (Rossouw and Scott 2011).



Fig. 2.21 Locality 9S. View of main exposures at northern end of locality. The cliff is capped by Tuff 1, below which is a series of waterlain tuffaceous clays and silts

Locality 10

Situated on the southern side of the Garusi valley, midway between the highest (western) peak of Norsigidok Hill and the Garusi River. A small seasonal stream flows westwards through the locality to join the Garusi River close to the western border of Loc. 10W. The large gully system is capped by a hard and resistant tuff, Tuff 3, which also forms the upper lip of a waterfall, about 5 m high, at the eastern boundary of the locality. Within the gully system is a series of cliffs and columns, capped primarily by Tuff 2. The stratigraphic sequence consists of about a 10 m section of the Upper Laetolil Beds from Tuff 3 to below Tuff 1. Most of the fossils are derived from between Tuff 2 and the bottom of the section. Fossil vertebrates are common, and include exceptionally well-preserved eggs of ground nesting birds (Harrison 2005). An isolated upper molar of *Australopithecus afarensis* (L.H. 31) was recovered from this locality in 1987 (Kyauka and Ndessokia 1990), but no precise provenance information accompanied the description of the specimen. Large termitaries and gastropods are common (see Darlington 2011; Tattersfield 2011). The Loc. 10 complex of localities (i.e., Locs. 10, 10E and 10W) was the area primarily surveyed by the Leakeys in 1935 and 1959 (Leakey 1987a).

Locality 10W

This locality is contiguous with Loc. 10, and represents the westward extension of the same series of sediments (Fig. 2.22). The exposures extend for about 1 km E-W along a gully system that is cut by the same seasonal river that passes through Loc. 10. As in Loc. 10, fossils are derived from below Tuff 2. These include two hominins (L.H. 10 and



Fig. 2.22 Locality 10W. View of main exposures of Upper Laetolil Beds. The hard dark grey tuff capping the pillars is Tuff 2

L.H., 11), both discovered in 1975 (Leakey 1987b). Fossil termitaries are especially common at this locality (Darlington 2011). In 1975 Mary Leakey set up camp on the western margin of the locality, at the confluence of the river that runs through Locs. 10 and 10W, at the same location as the 1935 and 1959 Leakey camps (Leakey 1987a).

Locality 10E

A large series of exposures in a circular depression about 0.7 km wide, which abuts against the north slope of Norsigidok Hill. Low cliffs that expose sediments between Tuffs 5 and 7 dominate the northeastern part of the locality, and this area has produced most of the fossils (Fig. 2.23). On the flanks of Norsigidok, the sequence of Upper Laetolil Beds continues above Tuff 7 through Tuff 8 to the Yellow Marker Tuff, and these are eventually capped by Ogot Lavas (Fig. 2.24). The section of Upper Laetolil Beds exposed, excluding the Yellow marker Tuff, is about 13–15 m thick. Fossil vertebrates have been recovered from between Tuffs 7 and 8, but these are less common than those between Tuffs 5 and 7. Loc. 10E is the most productive of the localities at Laetoli, with well over 2,500 fossil mammals recovered. Only a single hominin specimen has been recovered; an isolated P_3 (L.H. 24) discovered in 1978 (Leakey 1987b). The Footprint Tuff is well exposed at the locality, and several Footprint sites (F, H, I, J) have been designated (Leakey 1987c).

Locality 10NE

A poorly exposed area of Upper Laetolil Beds north of Loc. 10E and just south of the Garusi River. It is a flat area, covered with eroded sediments, and used heavily as a cattle path. Few fossil mammals have been recovered, and these tend to be fragmentary.



Fig. 2.23 Locality 10E. Section of Upper Laetolil Beds between Tuffs 5 and 7 that has yielded most of the vertebrate fossils. The figure in the white hat (Carl Swisher III) is kneeling on Tuff 7. The backpack of the seated figure (Lindsay McHenry), bottom right, is resting on Tuff 6

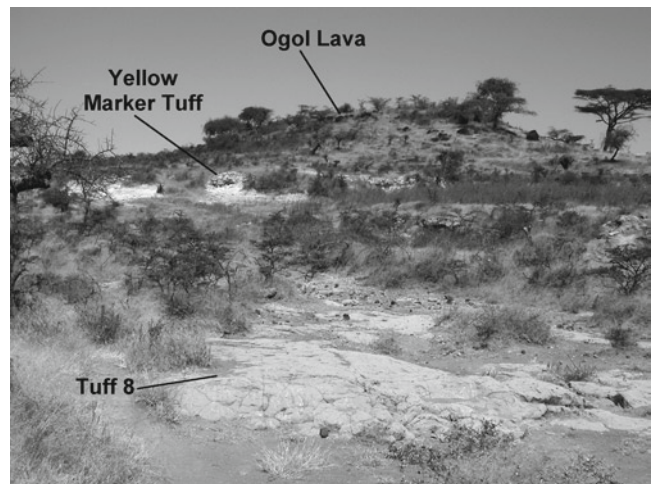


Fig. 2.24 Locality 10E. Upper section of the Upper Laetolil Beds, comprising Tuff 8 and the Yellow Marker Tuff, which are capped by Ogot Lavas on top of Norsigidok Hill

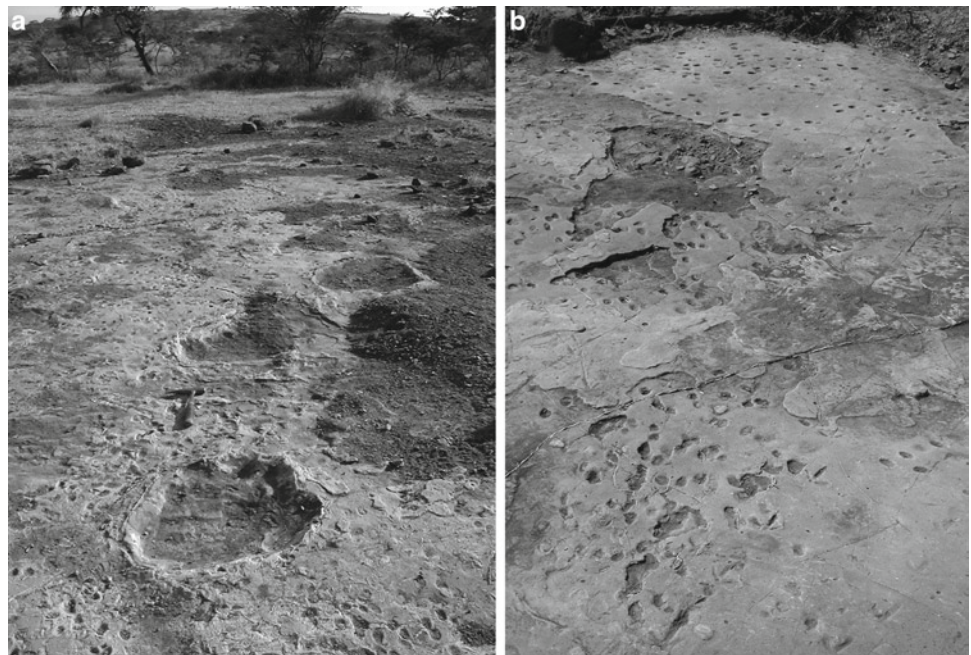
Locality 11

A narrow strip of outcrops of Upper Laetolil Beds, about 0.7 km in length, trending NE-SW. It is located on the southern side of the Garusi River valley, less than 0.5 km west of Loc. 4 and just east of Locs. 7 and 7E. It consists of a series of low cliffs (10–15 m high) and rounded hillocks that border the southwestern extension of Irkeeklekole Hill (Fig. 2.25). The surface of the locality is littered with large boulders of Ogot Lava derived from the cap of the hill. A small ephemeral river cuts along its west margin, passes through the break in the ridge south of Loc. 7E, and is eventually captured by the Olaitole River to the south. To the southwest and along the western margin of the locality Tuff 7 is well exposed, and

Fig. 2.25 Locality 11. View (northeast) of main exposures of Upper Laetolil Beds above Tuff 7. The locality is littered with large boulders of Ogol Lava derived from the cap of Irkeeklekole Hill



Fig. 2.26 Locality 11. Exposed surface of Tuff 7 with footprints. (a) A trail of an elephantid, with numerous small prints of *Serengetilagus* and *Madoqua*. (b) Numerous small prints and trails of *Madoqua* and guinea fowl (bottom center and right)



preserves numerous footprints (Footprint Sites D and E; Leakey 1987c) (Fig. 2.26). Fossil vertebrates are derived from the overlying tuffs between Tuffs 7 and 8. It is a relatively productive site, mainly because the tuffaceous sediments are soft and erode quickly. However, trampling by livestock from the nearby bomas (Maasai homesteads) results in a high degree of fragmentation of the fossils. Upper cheek teeth of a single individual of a hominin (L.H. 8 and L.H. 22), found two years apart, were recovered by Mary Leakey's team (Leakey 1987b).

Locality 12

This a narrow strip of exposures around the base of the Ndonyamati (or Oldonyo Mati) Hills overlooking the Olaitole

River valley to the north, and about 1.5 km south of the Garusi River. The valley and northern slopes of the Ndonyamati Hills are densely vegetated with tall grass, thick bush and open woodlands. A section of the Upper Laetolil Beds between Tuffs 5 and 8 are exposed, with most of the fossils derived from between Tuffs 5 and 6. Relatively few fossils have been recovered.

Locality 12E

A locality on the southern flanks of the Olaitole River valley, located just to the east of Loc. 12. A short section (about 9 m) of the Upper Laetolil Beds between Tuffs 5 and 7 are exposed, and these have yielded a good number of fossils, mostly from between Tuffs 6 and 7. The base of Tuff 7 is rich

in calcified twigs, seeds and roots. L.H. 21, a partial skeleton of an immature individual of *A. afarensis*, was recovered from this locality in 1976 (White 1980; Leakey 1987b; Kyauka 1994).

Locality 13

A series of low gullies and exposures on the northern side of the Garusi River valley, associated with several small channels that drain into the Garusi. It is located immediately west of Loc. 2 and about 0.3 km east of Loc 9, and separated from them by a flat expanse of grass and bush growing on mbuga clay. Although the locality covers a large area, extending about 1.5 km northwards from the Garusi River and E-W for 2 km, most of the exposures are poorly fossiliferous. The majority of the fossils are derived from the Upper Laetolil Beds between Tuffs 5 and 8, but a few have been recovered from exposures close to the Garusi River from between Tuffs 3 and 5. One of the most productive areas is a small E-W oriented drainage channel, about 100 m long, informally named “Snake Gully” (coordinates: 3° 12′ 15.1″ S, 35° 10′ 58.7″ E). Numerous fossil vertebrates have been collected from this gully, including a partial skeleton of a large viper with an immature *Serengetilagus* skeleton preserved in its abdominal cavity (Rage and Bailon 2011), derived from an horizon 2 m below Tuff 7. In addition, a few fossils have been recovered from the Upper Ndolanya Beds, and possibly also from the Ngaloba Beds. The Footprint Tuff (Tuff 7) is extensively exposed along the northern boundary of the locality, and includes Footprint Sites L, M and N (Leakey 1987c).

Locality 14

A small locality, situated between Locs. 2 and 13, about 2 km north of the Garusi River. It exposes tuffaceous channel-fill sediments of the Upper Ndolanya Beds. Excavations by Mary Leakey’s team produced numerous fossils (Leakey 1987a). Today, however, the locality is much overgrown and few new fossils have eroded out onto the surface.

Locality 15

This is the westernmost locality at Laetoli, situated at the head of the Emboremony River, about 1 km west of Ndolanya Hill. A short section of Upper Laetolil Beds, about 6 m thick, is exposed on the southern side of the locality (Fig. 2.27). This is overlain by poorly exposed deposits of the Yellow Marker Tuff and Upper Ndolanya Beds, as well as undifferentiated Pleistocene sediments. Upper Laetolil Beds between Tuffs 6 and 8 are exposed, but vertebrate fossils are mostly derived from between Tuffs 6 and 7. A few fossils of Late Pleistocene age, in association with stone tools and ostrich egg shell beads, were found scattered on the surface and derived from the mbuga clays and river alluvium. A newly discovered exposure of Upper Ndolanya Beds occurs on the northern side of the Emboremony along the western flank of Ndolanya Hill (coordinates: 3° 12′ 59.6″ S, 35° 08′ 51.5″ E). A rich fossil assemblage was found eroding out of a series of gullies and low rounded hillocks (Fig. 2.28). The fossils include numerous complete and partial skulls of lagomorphs and rodents, as well as a skull and partial skeleton of a new

Fig. 2.27 Locality 15. Main exposure of the Upper Laetolil Beds on the southern flank of the Emboremony River valley. The thick tuff running left to right across the center of the figure is Tuff 7. The top of the section exposes the Yellow Marker Tuff (the light colored sediment that the middle figure is standing on) and undifferentiated Pleistocene sediments (darker sediments above)





Fig. 2.28 Locality 15. Main exposures of the Upper Ndolanya Beds on the northeast flank of the Emboremony River valley

species of medium-size alcelaphine (Gentry 2011). In addition to fossil vertebrates, which are primarily found in the lower part of the section, cocoons and brood cells of solitary hymenopterans are very common, especially in the upper part of the section. A second, smaller outcrop of Upper Ndolanya Beds (coordinates: 3° 12' 42.0" S, 35° 08' 35.3" E) occurs about 0.6 km to the northeast, but this has yielded few identifiable fossils.

Locality 16

A richly fossiliferous locality on the north side of the Garusi River valley, situated just east of Loc. 3 (Fig. 2.29). It is associated with two ephemeral streams that drain into the Garusi River. The exposed section of Upper Laetolil Beds extends from below Tuff 6 to the Yellow Marker Tuff, but the vertebrate fossils are all derived from between Tuffs 7 and the Yellow Marker Tuff. The western portion of the locality, which extends N-S for about 0.6 km, represents the main gully, and is the most productive. The eastern arm, which extends NE-SW for approximately 0.7 km, is much less fossiliferous. Tuff 7 is well exposed along the floor of the river courses, and it forms a resistant layer capping waterfalls along both the eastern and western tributaries. The base of Tuff 7, which is well exposed in several places, is densely packed with calcified plant material, including wood, twigs (up to 3 cm in diameter), a diversity of seeds, root casts, and fine root mats (Fig. 2.30). A number of small, vertically standing boles penetrate Tuff 7, and these presumably represent the remains of trees that were partially buried by the ash fall. At the eastern end of the locality, a number of leaf impressions are preserved in a coarse-grained dark grey tuff at the top of Tuff 8 (Bamford 2011a). At the northern end of the western arm, there is a section of Yellow Marker Tuff

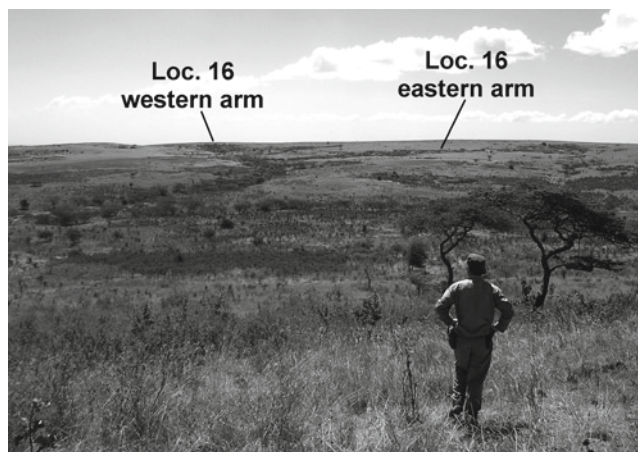


Fig. 2.29 Locality 16. View (north) across the Garusi River valley. The western and eastern arms of Loc. 16 are visible as a line of trees associated with the main gullies



Fig. 2.30 Locality 16. Fossil seeds, twigs and wood exposed on the basal layer of Tuff 7 in the eastern arm of Loc. 16

about 6 m thick. This is overlain by the Olpiro Beds, which contain large mammal fossils and stone tools (although Leakey [1987a] suggests that most of these may originally have been derived from the Ngaloba Beds) (Fig. 2.31). Excavation by J.W.K. Harris at “Grubb’s site” in Loc. 16 produced an Early Stone Age assemblage dominated by core tools and crudely made bifacial tools (Harris and Harris 1981). Ndessokia conducted further excavations at Loc. 16 in 1987, and recovered additional Oldowan artifacts in association with vertebrate fossils (Ndessokia 1990).

In 2000 Michael Mbago found a mandibular fragment with P_3 - M_1 (EP 2400/00) of *Australopithecus afarensis* at this locality. This is only the fifth mandibular specimen of a hominin to be recovered from Laetoli, and the first hominin



Fig. 2.31 Locality 16. Main exposure of Olpiro Beds at the northern end of the western arm of Loc. 16

specimen to be found at Loc. 16 (Harrison 2011b). The specimen was found on the surface, near a small mound of soft pale grey calcareous tuff, within a shallow drainage channel on the western flank of the main gully (Fig. 2.32). It was located 12.1 m from the edge of the gully and 49.7 m from the main river course, at a distance of 56 m upstream from the waterfall (coordinates: $3^{\circ} 12' 10.9''$ S, $35^{\circ} 12' 51.7''$ E). It is possible that the specimen had been transported a short distance from its original location. There are no fresh breaks, and it is likely that the specimen was initially buried and fossilized in the same fragmentary condition as it was found. A diligent search and screening of the surface sediment failed to yield additional jaw fragments or associated teeth. In terms of stratigraphic position, the hominin was found 51 cm above Tuff 8. Since only 1.32 m of Laetolil Beds are exposed above this horizon, the original provenance of the specimen can be fairly tightly constrained stratigraphically to 0.5–1.3 m above Tuff 8 (Fig. 2.33).

Earlier the same year, Amandus Kweka discovered an isolated left lower canine of *A. afarensis* (EP 162/00) from Loc. 16 (Harrison 2011b). It was found on the surface between Tuffs 7 and 8.

Locality 17

A small locality situated a short distance east of Loc. 16 on the northern side of the Garusi River valley. A short section of the Upper Laetolil Beds above Tuff 7 is exposed. Although few fossils have been recovered, it has produced examples of some relatively rare taxa, such as *Paracolobus* and *Orycteropus*. One of the tuffaceous horizons contains a dense aggregation of unbranched vertical burrows leading to brood

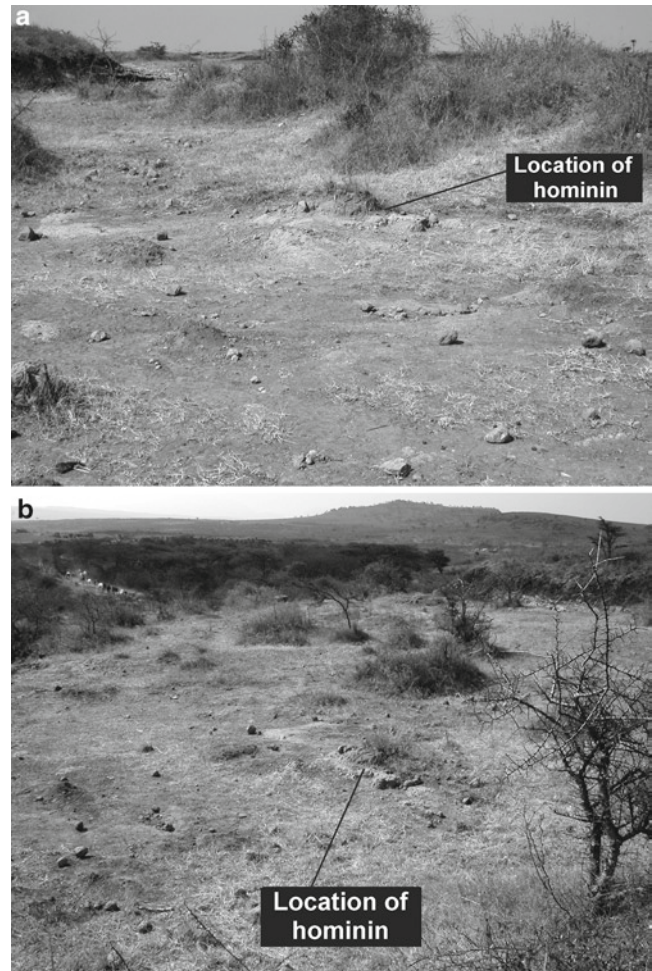


Fig. 2.32 Locality 16. Location of the hominin mandibular fragment (EP 2400/00) discovered in 2000. (a) View (southwest) of the western flank of the western arm of Loc. 16. (b) View (southeast) of the western flank of the western arm of Loc. 16. The river gully is visible as a line of trees in the top right and center. Irkeeklehole Hill is in the background

cells of solitary hymenopterans. The tunnels, up to 7 cm deep, are densely packed, with less than 1 cm separating neighboring burrows, and with an estimated density of over 2,000 burrows per square meter (Fig. 2.34).

Locality 18

This is the largest and most productive of the Upper Ndolanya localities. It is located at the head of the Gadjingero River on the southern side of the valley. It is separated from the Garusi valley by a low grassy rise, about 0.5 km north of Loc. 2. Additional small exposures of Upper Ndolanya Beds occur along the northern side of the valley. Upper Laetolil Beds occur for about 2.5 km along the river course, but these are poorly exposed, with a heavy overburden of mbuga clays,

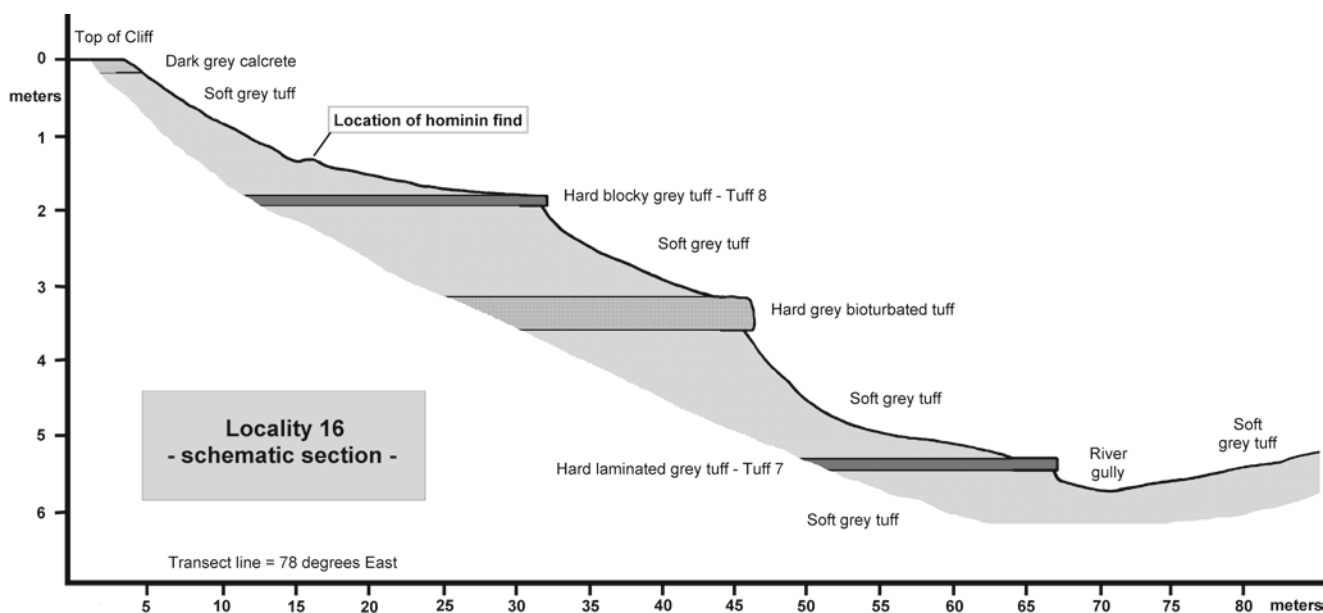


Fig. 2.33 Schematic stratigraphic section at Locality 16 where EP 2400/00 was discovered. The hominin was found 51 cm above Tuff 8. Note that the vertical and horizontal axes are different scales

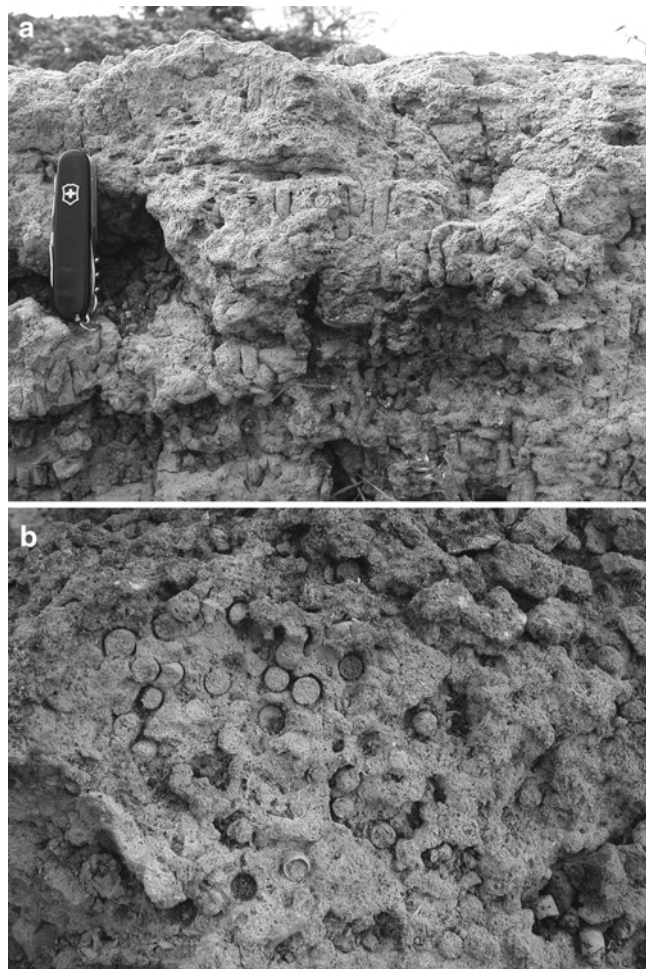


Fig. 2.34 Locality 17. Tuff of Upper Laetolil Beds preserving an aggregate of burrows and brood cells made by solitary hymenopterans. (a) Lateral view; (b) Surface view



Fig. 2.35 Locality 18. Main exposures of the Upper Ndolanya Beds

and they are generally poorly fossiliferous. The sides of the valley are mostly gently sloping and covered with grass and open acacia woodland. Good exposures of the Upper Ndolanya Beds are typically found where the cliff faces are steep and actively eroding. The main outcrops extend for more than 200 m, and the exposed section of Upper Ndolanya Beds is at least 8 m thick (Fig. 2.35). A distinctive pedogenic calcrete about midway up the section divides the Beds into two units. Fossil vertebrates are common in both units, consisting predominantly of bovids. Cocoons and brood cells of solitary hymenopterans are common throughout the section, but are most abundant in the upper unit.

This locality was known as Gadjingero by Kohl-Larsen (see Table 2.1), who recovered a large sample of fossils. In addition to extensive surface collections, Mary Leakey conducted systematic excavations in 1976, but few fossils were recovered. Subsequent excavations were carried out by Prosper Ndessokia (in 1987–1988), and more recently by teams led by

Charles Musiba. Kaiser et al. (1995) identified putative artifacts from the surface of the Ndolanya Beds at Loc. 18, but these probably derive from higher in the sequence. Excavations by Leakey and Ndessokia failed to produce any stone tools *in situ*, and subsequent investigations have found no evidence to support the occurrence of stone tools in the Upper Ndolanya Beds, either at Loc. 18 or elsewhere at Laetoli.

Locality 19

This is a small locality on the northwestern flanks of the Ndonyamati Hills overlooking the Olaitole River valley. It is situated about 200 m west of Loc. 12. The Upper Laetolil Beds between Tuffs 5 and 8 are exposed along a series of low cliffs, up to 5 m in height. The surrounding area is thickly vegetated with dense bush and open woodland. The locality has yielded few fossils, but a partial lower dentition of *A. afarensis* (L.H. 14) was recovered in 1975–1976 (Leakey 1987b).

Locality 20

This is another small locality on the southern side of the Olaitole River (Fig. 2.36). It is situated about 250 m west of Loc. 19, on the heavily vegetated northwestern flank of the Ndonyamati Hills. The locality represents a series of discontinuous and poorly exposed outcrops, with a lateral extent of about 100 m. Fossils are derived from the Upper Laetolil Beds between Tuffs 6 and 8, but are not common.



Fig. 2.36 Locality 20. Exposure of the Upper Laetolil Beds. The Ndonyamati Hills are in the background. Blocks of Ogol Lava, derived from the top of the Ndonyamati Hills, are scattered on the Laetolil Beds in the foreground

Locality 21

This is the most productive of the localities on the southern side of the Olaitole River, situated just to the west of Loc. 20. The locality consists of a series of deep gullies, with cliffs up to 6 m in height, which extend E-W for about 120 and 200 m downslope. The surrounding area is thickly vegetated with dense bush and woodland. Fossils are eroding out of the Upper Laetolil Beds between Tuffs 5 and 7, but are most abundant between Tuffs 6 and 7. The Footprint Tuff (Tuff 7) is exposed in the middle of the section, and is associated with calcified plant material.

Locality 22

An extensive locality on the northern side of the Olaitole River, on the opposite side of the valley to Loc. 21. It is separated from the Garusi River valley to the north by a low bush covered ridge capped by Ogol Lavas. It is located about 1 km southeast of Loc. 10E. The locality is situated in a large N-S oriented river gully that drains into the Olaitole River. It is quite heavily vegetated, with small discontinuous exposures of Upper Laetolil Beds. A relatively thick section (about 32 m thick) of Upper Laetolil Beds from Tuff 7 at the northern end of the locality to below Tuff 1 is exposed. Most fossil vertebrates have been recovered from between Tuffs 5 and 7, but a few vertebrates and a good sample of terrestrial gastropods have been recovered from between Tuffs 1 and 2. At the southern end of the gully, the stream cuts through the top part of the Lower Laetolil Beds (about 6 m in thickness), but these appear to be devoid of fossils. At the entrance to the gully at the southern end of the locality, and along a low ridge to the east, the Yellow Marker Tuff is overlain by a relatively thick series of Ndolanya Beds. These beds have yielded a small sample of fossil vertebrates, especially large bovids.

Locality 22E

This locality is situated about 0.5 km to the east of Loc. 22 on the northern side of the Olaitole River valley. It is separated from Loc. 22 by a low dipping ridge with a narrow cattle path running N-S that allows access by car between the Garusi and Olaitole valleys. As at Loc. 22, Loc. 22E is associated with a tributary of the Olaitole River that drains south into the main watercourse. The area is heavily vegetated and outcrops are discontinuous and poorly exposed. The Upper Laetoli Beds are represented by a section between Tuffs 2 and 7. Most of the fossils have been recovered from between Tuffs 5 and 7, but a few fossils have been recovered lower in the section from between Tuffs 2 and 4. Tuff 3 is extensively

exposed in the valley floor. The upper part of the tuff preserves a rich concentration of calcified plant remains, especially mats of fine roots, possibly of grasses, with individual roots less than 2 mm in diameter. In one location (coordinates: 3° 14' 30" S, 35° 11' 52" E) Tuff 3 preserves numerous footprints, especially those of guinea fowl and small mammals. On the eastern flank of the divide between Loc. 22 and Loc. 22E is an extensive series of Upper Ndolanya Beds that have yielded a small sample of fossils.

Locality 22S

This is a newly discovered locality, being first recorded in 1998. It is located south of Loc. 22, further along the same tributary of the Olaitole River, about 4.5 km south of the Garusi River and 4 km north of Esere village. It is the southernmost locality at Laetoli. The topography of the area is relatively flat, and a tributary of the Olaitole meanders across a broad and low valley with dense grass and bush cover. On the western side of the valley is a series of low cliffs, which expose a short section of the Upper Laetolil Beds (about 8 m thick) between Tuffs 1 and 3. Tuff 3 forms the hard resistant cap to the cliffs. The base of Tuff 3 contains an abundance of calcified twigs and root casts. A downfaulted section of the Upper Laetolil Beds with Tuffs 3–5 is exposed in the floor of the valley. Very few fossils have been recovered from these beds. The importance of the locality is that a small outcrop of Upper Ndolanya Beds occurs in a faulted zone of the Upper Laetolil Beds, and this has produced a rich vertebrate fauna, including a proximal tibia of a hominin. This latter specimen (EP 1000/98), found by Chris Robinson in 1998, was the first postcranial specimen of an adult individual to be recovered from Laetoli (Harrison 2011b). The Ndolanya Beds are exposed as a small rounded hillock, about 10 m high and 30 m wide, bordered on either side by steep cliffs formed by the Upper Laetolil Beds (coordinates: 3° 15' 30" S, 35° 11' 9.3" E) (Fig. 2.37). The area is



Fig. 2.37 Locality 22S. Nenguruk Hill. Exposure of Upper Ndolanya Beds. The location of the hominin proximal tibia (EP 1000/98) found in 1998 is indicated

known locally as Nenguruk, and the hillock represents a distinctive and visible feature within the Olaitole Valley. Eroded sections of Nenguruk Hill shows that the Upper Ndolanya Beds rest unconformably on a downfaulted block of Upper Laetoli Beds capped by Tuff 3, which dips westwards at an angle of 20° towards the center of the valley.

The proximal tibia was found partially buried in loose sediments at the foot of Nenguruk Hill, at a distance of 3.09 m from the base of the slope, within a shallow NE-oriented gully that carries run-off down the northern side of the hill. Although the specimen had clearly been transported from its original location, the context and preservation of the specimen clearly indicates that it was originally derived from the Upper Ndolanya Beds, along with the numerous other vertebrate remains recovered. A thorough search of the locality and sieving of the sediments in the gully produced no additional fragments or further hominin finds. The nature of the breaks indicates that the proximal end of the tibia was all that was preserved when it was originally buried and fossilized (Harrison 2011b).

Locality 23

This locality extends along a shallow gully system cut by a tributary of the Gadjingero River, about 1 km northeast of the main watercourse on which Loc. 18 is situated. It is located 1.5 km north of the Garusi River valley (Loc. 16) and 1.5 km west of the Nompopong River valley (Loc. 1). There is little topographic relief and the main gully cuts through thick deposits of mbuga clay, Ngaloba Beds, and the upper part of the Upper Laetolil Beds, especially the Yellow Marker Tuff. Few fossils were recovered from the river gully itself. Located on the northern flank of the river valley, at the top of a small tree-lined side gully, gently undulating hillocks expose fairly extensive outcrops of Lower Ngaloba Beds (Fig. 2.38). These beds contain numerous fossils vertebrates and Acheulian



Fig. 2.38 Locality 23. Exposures of Lower Ngaloba Beds on the northern flank of a tributary of the Gadjingero River



Fig. 2.39 Bifacial tool found on the surface of the Lower Ngoloba Beds at Locality 23

tools (Fig. 2.39). Harris and Harris (1981) presented a preliminary account of archaeological excavations conducted in September 1979. The tools, predominately made of calcrete, were associated with well-preserved remains of large mammals.

Locality 24

Exposures located just to the north of Loc. 10NE, on the northern side of the Garusi River. A short section of the Upper Laetolil Beds above and below Tuff 7 is exposed. These have yielded fossil mammals, but generally the locality is not very productive. The locality was indicated as unnamed outcrops of Upper Laetolil Beds on the locality map of Leakey (1987a, Fig. 1.2), but these were not given a collecting locality designation.

Garusi SW

These are an extensive series of exposures of Upper Laetolil Beds located along the Garusi River Valley west of Loc. 10W. They are situated on the southern side of the Garusi River, on both sides of a promontory, about 2 km southwest of Norsigidok Hill. The outcrops consist of the upper section of the Upper Laetolil Beds above Tuff 8, and primarily consisting of unfossiliferous Yellow Marker Tuff. Fossils do occur in the beds below the Yellow Marker Tuff, but these are scarce. The exposures in this area were initially identified as belonging to the Laetolil Beds by Kent (1941), but fossils were first recovered from this locality in 1998.

Silal Artum

This locality was first discovered in 2001, and is the northernmost collecting locality at Laetoli. It is located 4.5 km north of the Garusi River, on the western flank of the Nompopong River, just to the northwest of Loc. 1NW. The locality is represented by a shallow gully at the base of a grassy hill that forms the divide between the Gadjingero and Nompopong River valleys. Immediately to the east, the Nompopong River exposes a section of Upper Laetolil Beds (16 m thick), which can be traced down to Tuff 5 and is capped by the Yellow Marker Tuff. The latter is overlain by 3 m of Upper Ndolanya Beds, which have produced a rich assemblage of fossils. This was the site of discovery, in 2001, of an edentulous maxilla of *Paranthropus aethiopicus* (EP 1500/01), only the second hominin find from the Upper Ndolanya Beds (the first being the proximal tibia from Loc. 22S found in 1998) (Harrison 2002, 2011b). The specimen was found on the surface, partially buried in loose detrital sediment at the edge of a small acacia thicket, where it was protected from being (further) trampled by livestock (Figs. 2.40 and 2.41). The level at which the specimen was found was 2.55 m below the top of the section and 40 cm above a hard pale brown tuff that forms the base of the exposed section of the Upper Ndolanya Beds. The Upper Ndolanya Beds are capped by a hard dark grey calcrete, which is probably Pleistocene in age (Fig. 2.42). Based on the degree of weathering and abrasion, and on the position of the specimen, it is clear that the fossil had eroded out of and been transported from its original burial location (but there is no doubt that it was originally derived from the Upper Ndolanya Beds). However, assuming that it came from an exposure further upstream, the maximum distance that it could have been transported is 30 m. The entire locality was thoroughly searched and the surface sediment in the immediate vicinity of the discovery was sieved (about 150 m²), but no

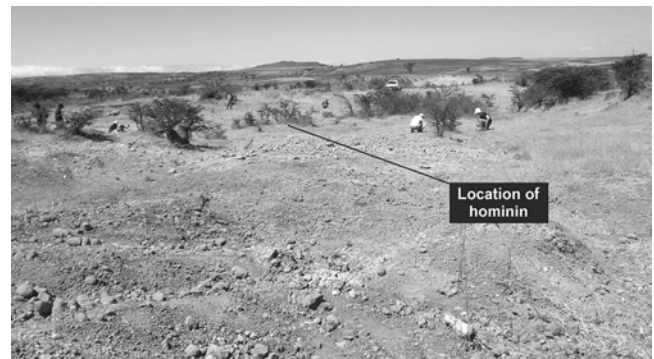


Fig. 2.40 Silal Artum. View (south) of main exposure of Upper Ndolanya Beds. The location of the fossil hominin maxilla (EP 1500/01) discovered in 2001 is indicated

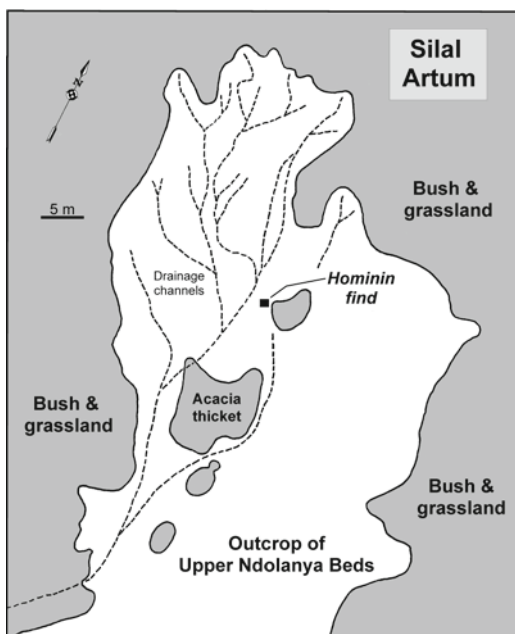


Fig. 2.41 Silal Artum. Plan of the exposure of the Upper Ndolanya Beds at the northern end of the locality (*in white*). Vegetation and recent soil cover is indicated by grey shading. The hominin maxilla (EP 1500/01) was found at the edge of a small clump of acacia and grass (see Fig. 2.40), but the specimen was evidently transported downslope from the northern end of the locality (see text for more detail)

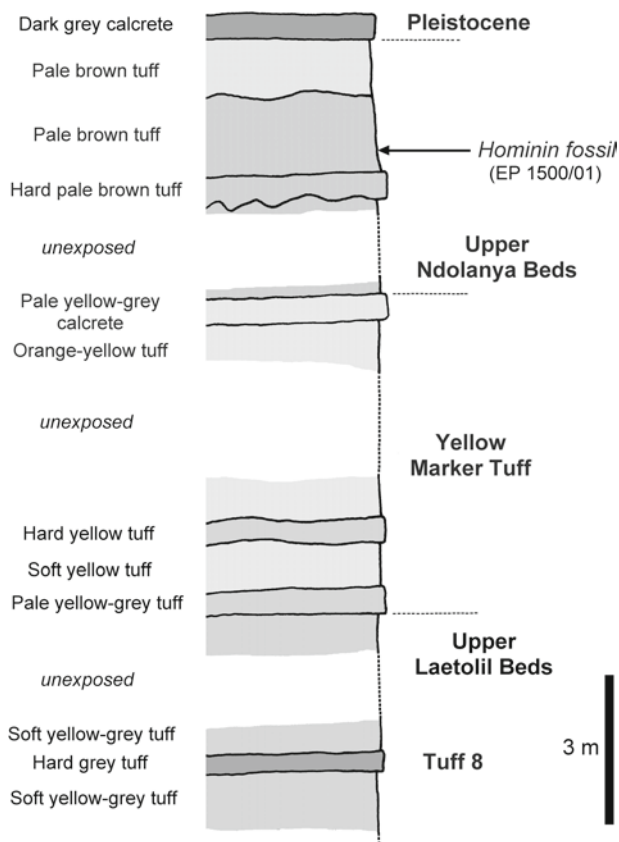


Fig. 2.42 Silal Artum. Upper part of the stratigraphic section at Silal Artum, showing the horizon from which the hominin maxilla (EP 1500/01) was recovered

additional pieces of the specimen were recovered. It is evident from the preservation of the maxilla that the teeth had been lost for a long time prior to its recovery.

Other Paleontological Localities on the Eyasi Plateau

Kakesio

Kakesio is represented by an extensive series of exposures of Lower Laetoli Beds to the east and northeast of Kakesio village, associated with the main course of the Kakesio River and its tributaries. The Kakesio localities are located 40 km southwest of the Laetoli area, and can be reached by road via Endulen. The main outcrops are located about 2 km north of the village of Kakesio, and extend E-W for 5.5 km, about 1 km north of the main Endulen-Kakesio road (Fig. 2.43). This corresponds to Area 5 of Hay (1987; Fig. 2.2). To better constrain the provenance of the fossils collected, this large area has been subdivided, using promontories and gully systems as natural boundaries, into several contiguous collecting localities. These are numbered Kakesio 1 to 6, arranged sequentially from west to east.

The localities consist of a series of E-W trending cliffs facing south towards the Kakesio River. The outcrops are well-exposed along the low slopes and shallow gullies that extend from the cliffs, but closer to the river they are heavily vegetated. The exposed section is 18–20 m thick and consists primarily of massive light yellow-grey to pale brown tuffs, which show variable degrees of bioturbation. The base of the section consists of waterlain tuffs, clays, mudstones, and conglomerates, which rest unconformably on the gneiss basement rocks.

Several smaller outcrops of Lower Laetoli Beds are located east of Kakesio village, south of the Endulen-Kakesio road, and are associated with tributaries of the Kakesio River. The general area is quite densely vegetated bush and open woodland, and the main outcrops consist of eroded cliffs



Fig. 2.43 Kakesio 6. Exposures of Lower Laetoli Beds

along the flanks of the river gullies. These localities are designated as Kakesio 7–10. Kakesio 7 is the easternmost outcrop, located about 1 km south of the Kakesio River, and about 2 km southeast of Kakesio 6. Kakesio 8 is 1.2 km further west, and it represents an extensive series of outcrops along the eastern side of the Lorotian River. Kakesio 9 is located 3 km south of the Kakesio River, at the head of a small ephemeral stream. It consists of a circular depression surrounded by low cliffs. Just south of this locality (about 0.5 km) the Precambrian basement can be observed along the shoulder of the Eyasi Plateau. Kakesio 10 is the southernmost of the Kakesio localities, and it is situated 4.2 km south of the Kakesio River, along the western flank of the west branch of the Lorotian River, 1.7 km further upstream from Kakesio 8. The outcrops are quite extensive, forming a series of high cliffs (Fig. 2.44).

All of these localities have yielded fossil vertebrates, as well as gastropods, termitaria and traces of hymenopterans. The Lower Laetolil Beds are generally much less productive than the Upper Laetolil Beds, and only 144 fossil mammals have been recovered from the Kakesio localities combined since 1998. Nevertheless, more intensive surveys of the Kakesio outcrops may prove rewarding in the future. Kakesio 6 is the most productive locality, having yielded good samples of *Anancus*, *Ceratotherium*, bovids and equids. Fossil vertebrates are found throughout the section, but appear to be most abundant in the lowermost 5 m. The most common fossils in the upper part of the section are small ovoid termitaries (30–50 cm in diameter), bee brood cells and cocoons, terrestrial gastropods, tortoises, and ostrich egg shell fragments. Terrestrial gastropods are dominated by *Limicolaria* and *Achatina*, which are often found in dense concentrations in the subaerially deposited tuffs in the upper part of the section. These aggregations are presumably the result of gastropods that burrowed down into the loosely compacted sediments to aestivate, and were buried by subsequent eruptive events. Calcified wood and root casts (2–5 cm in diameter) are abundant in some levels.



Fig. 2.44 Kakesio 10. Exposures of Lower Laetolil Beds

Vertebrate fossils tend to be scattered and fragmentary, and they commonly show evidence of weathering and rodent gnawing. Kakesio is the only locality on the Eyasi Plateau that has yielded large aquatic vertebrates (i.e., crocodiles), and supports evidence from the geology that fluvial sediments at the base of the Lower Laetolil Beds were associated with permanent or seasonal bodies of water (probably a shallow swampy depression with ephemeral streams, but not a major river or lake system). Dick Hay investigated the geology and paleontology of the Kakesio area in 1982, as part of Mary Leakey's expeditions to the Laetoli area, but the results of his work were never published in detail. The 1982 collections include a small sample of fossil vertebrates, including partial skeletons of *Parahyaena howelli* and aff. *Proteles* sp. (Werdelin and Dehghani 2011).

Kakesio South

A series of low hills and cliffs beginning just south of Kakesio village, and extending southwest for about 3 km. These expose Lower Laetolil Beds comparable to those at Kakesio. Only a few mammalian remains have been recovered, but tortoises, ostrich egg shells, and invertebrate fossils are quite common.

Emboremony

Several fossiliferous outcrops are exposed along the Emboremony River valley, about 10 km to the southwest of Laetoli and 4 km northeast of Kakesio. In this region, the Emboremony River passes through a relatively flat valley, about 4 km wide, with a heavy covering of mbuga clay. The sides of the valley expose Lower Laetolil Beds and Ngaloba Beds. This corresponds to Area 7 of Hay (1987; Fig. 2.2). The best exposures occur along the low sloping cliffs that form the southwestern flank of the valley, about 1.5 km from the main watercourse. Although fossils are found along the entire length of the cliffs, two areas are especially productive and these have been designated at Emboremony 1 and Emboremony 3. On the opposite side of the river valley, about 4 km east of Emboremony 1, there is another productive locality, designated as Emboremony 2.

Emboremony 1 is located 5.5 km north of the Endulen-Kakesio road, 2.7 km west of the Emboremony River. The exposures extend south for about 1 km before low relief and heavy vegetation obscure the outcrops. A section of more than 14 m of Lower Laetolil Beds are exposed, overlain by outcrops of Ngaloba Beds. The former are comparable to the sediments at Kakesio, and consist of massive yellow-grey and pale brown tuffaceous sediments, that grade down to weakly bedded waterlain tuffs and

clays. The middle section is the most fossiliferous and contains vertebrates, abundant gastropods *in situ*, and numerous small ovoid termitaries. Fossil bones of large mammals are also common in the Ngaloba Beds, especially bovids and *Equus*, and these are sometimes found mingled together with those from the Laetolil Beds (but in most cases are easily discriminated based on preservation and coloration).

Emboremony 2 is located on the northeast side of the valley. It is visible from Emboremony 1, but separated from it by a flat, sparsely vegetated area, thickly mantled in mbuga clay, on either side of the Emboremony River. The low slopes and gullies that expose the Lower Laetolil Beds extend N-S for a little over 1 km. Once again, surface finds of fossils are derived from two distinct beds, and are distinguished by their contrasting preservation. Heavily mineralized grey-colored fossils, often with bright orange staining, are derived from the Lower Laetolil Beds. The lighter, less heavily mineralized, white to yellow-brown fossils are derived from the overlying dark brown claystones of the Ngaloba Beds. The exposed section is about 10 m thick. The lowermost 5 m represents the Lower Laetolil Beds, consisting of massive pale grey tuffs, heavily bioturbated in the upper section, grading down to pinkish-brown tuffs. In addition to fragmentary bones and isolated teeth of large mammals, small ovoid termitaria are common. Above this is 3.6 m of dark brown to orange claystones and laminated grey tuffaceous clays representing the Ngaloba Beds. In addition to the bones of large mammals, especially *Equus* and large-sized bovids, the surface of these beds has an extensive litter of stone artifacts, including quartzite flakes and hammerstones, as well as cores of lava and chert. The Ngaloba Beds are capped by a thick grey calcrete.

Emboremony 3 is located 5 km south of Emboremony 1 on the southwestern flank of the Emboremony River, about 1 km north of Olaltanaudo. The locality consists of a U-shaped gully with a series of steep cliffs that expose a short section of the Lower Laetolil Beds. Fossil vertebrates are rare, except for ostrich eggshell fragments.

Esere

The localities at Esere represent small fossil-bearing outcrops that occur in the extensive exposures of Lower Laetolil Beds near the village of Esere, south of the Endulen-Kakesio Road. This area was referred to as Laetoli Springs by Kent (1941). Three separate localities have been designated, Esere 1, 2 and 3. Esere village is located 12 km southwest of Endulen, along the main Endulen-Kakesio Road. The localities are all situated on the western flank of the Olaitole River, as it drains southwards from the Laetoli area into Lake Eyasi. Esere is located 3.5 km south of Loc. 22S, the southernmost of the

Laetoli localities associated with the Olaitole River. Esere 1 is located 2 km southwest of the village. It has yielded a small collection of fossil vertebrates and terrestrial gastropods. The fossils are derived from a pale grey tuff and underlying red tuff. Both horizons are heavily calcified and resistant to weathering, so fossils erode out of the sediment very slowly. The Lower Laetolil Beds are overlain by mbuga clay, which are associated with a scatter of Pleistocene fossils.

Esere 2 is located 2.5 km south of Esere 1. It consists of a series of low cliffs that expose pale yellow-grey tuffs of the Lower Laetolil Beds, heavily bioturbated by termite burrowing. Fossil vertebrates are not common, but a partial skeleton of a suid was recovered. Brood cells and cocoons of solitary bees are abundant. Esere 3 is 3 km south of Esere 2. It is located at the southernmost limit of the Laetolil Beds, very close to the exposed Precambrian basement rocks on the elevated shoulder of the Eyasi rift scarp, near the peak of Ngaiborgoso. The locality consists of an extensive series of low cliffs, exposing grey-brown tuffs that have been much bioturbated due to termite activity. Few fossil vertebrates have been recovered, but terrestrial gastropods and traces of solitary bees are common.

Kent (1941) made brief reference to “mastodon” (*Anancus kenyensis*) teeth that were collected in this area by Leakey in 1935. The exact location is not recorded, but according to Kent (1941) the specimens were recovered from Laetolil Beds on the southwest slopes of Eseketeti (= Speer Mountain) near the Rift scarp. Additional information is provided on a handwritten note (in L.S.B. Leakey’s writing) associated with the specimens in The Natural History Museum in London. The locality is referred to as Endolele or Endulele, and is located near the “Spring” about 8 miles away from the Laetoli area. This would be consistent with the spring at Esere. There is a village called Ndulele, about 7 km southwest of Kakesio village, but there are no Laetolil Beds exposed in the vicinity, and its location does not match that of Kent’s description. Leakey (1935), in an unpublished report, indicates that the “the teeth of a mastodon and of a primitive elephant” came from “a place where the base of the Laetolil series was seen resting on granite...”. Again, this would be consistent with the outcrops at Esere. Sanders (2011) suggests that the *Anancus* specimens from Endolele are more primitive than those from Kakesio, implying that the Lower Laetolil Beds at Esere might be somewhat older than those at Kakesio.

Engesha

An extensive series of outcrops of the Lower Laetolil Beds about 2.5 km northeast of Esere village, south of the Endulen-Kakesio road, at the head of the Nasero River valley. The gullies expose more than 30 m of Lower Laetolil Beds, consisting

of massive grey-brown tuffs with intercalated fluvial facies. A preliminary survey of the area has produced a few vertebrate fossils. Engesha is located just to the north of the Noiti area, and the sediments exposed are a continuity of those found at Noiti 3 (see below).

Lobileita

An extensive outcrop of Lower Laetolil Beds located in a large valley about 3.5 km south of the village of Sinoni, at a place called Lobileita. This corresponds to Area 6 of Hay (1987; Fig. 2.2). The valley is formed by a series of gullies that drain eastwards into the southern end of the Garusi River. The outcrops represent a remnant of the Laetolil Beds. To the southwest, elevated Precambrian inselbergs extend along the Eyasi Rift escarpment. The rocky peak of Enaiborkrum, at an elevation of 1,936 m, is located 3.5 km to the southwest of Lobileita, while 10 km away is Eseketeti (1,965 m) at the edge of the escarpment. To the east of Lobileita are the grassy plains of the Garusi valley, at about 1,600 m elevation, which expose an extensive series of Precambrian rocks. Laetoli Beds can be traced for only about 1 km south of Lobileita, after which they give way to the underlying gneiss basement rocks. A 17 m section of Lower Laetolil Beds is exposed at Lobileita, consisting predominantly of massive yellow-grey and pale brown tuffs, with weakly bedded sandstones and conglomerates at its base. The sediments are capped by a resistant red-orange calcrete, and they rest unconformably on the basement. The bottom half of the section has yielded fossil vertebrates, ostrich egg shell fragments, terrestrial gastropods, termitaries and traces of solitary bees.

Olaltanaudo

An extensive series of outcrops of Lower Laetolil Beds along the Endulen-Kakesio road, about 2.5 km west of the Sinoni junction. The locality is situated just south of Emboremony 3 and 5.5 km east of Kakesio 6. This is equivalent to Area 4 of Hay (1987; Fig. 2.2). The exposures occur along low cliffs to the south and west of the Olaltanaudo Dam. Few fossils have been recovered.

Oleisusu

A locality on the southern flanks of the Oldogom River valley, 2 km south of the village of Endulen. The river gully exposes an extensive series of Upper Laetolil Beds, but the stratigraphy has not yet been fully investigated. Fossils

have been recovered from between Tuffs 7 and the Yellow Marker Tuff.

Ndoroto

A small locality on the east side of the track leading from Endulen to Olduvai Gorge, about 2.3 km northeast of Endulen hospital (coordinates: 3° 11' 04" S, 35° 16' 57" E). The general area is known as Orumekeke, but according to local informants the specific location is named Ndoroto. The site consists of a small series of steep cliffs, comprising 12 m of Yellow Marker Tuff overlain by Ogol Lavas. At the base of the section are pale grey tuffs of the Upper Laetolil Beds that have yielded a few fossil vertebrates.

Noiti 1-3

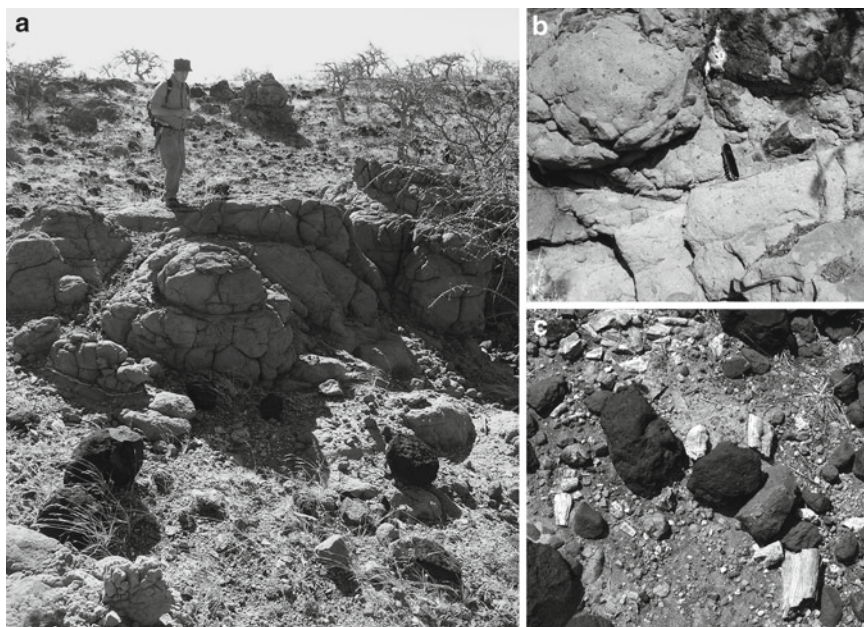
The Noiti area is situated 3 km southeast of Esere village, and can be reached by foot from the main Endulen-Kakesio Road. This is the equivalent of Area 2 of Hay (1987; Fig. 2.2). Harrison's team was first directed to Noiti in January 1999 by Mr. Simon Mataro, the Antiquities superintendent at Laetoli. Subsequent surveys of the area have allowed the designation of three separate collecting localities, Noiti 1, 2 and 3.

Noiti 1 was the first locality visited in 1999. It is located on the eastern flank of a small tributary of the Nasera River, with a lateral extent of only about 50 m (Fig. 2.45). There are no fossil vertebrates, but the surface of the locality is littered with well-preserved fossil wood, up to 15 cm in diameter (Bamford 2011b). The fossil wood is associated with a pyroclastic mudflow, which filled a paleochannel that cuts into the underlying Lower Laetolil Beds. The lahar can be seen resting unconformably on a light grey tuff at the base of the sequence that represents the eroded surface of the Lower Laetolil Beds. The massive lahar, 10–13 m thick, is weakly differentiated into a bright red upper unit, an orange-brown tuffaceous agglomerate with poorly-sorted subangular clasts (some up to 1 m in diameter) in the middle of the section, and a pale grey-green agglomerate with smaller inclusions (up to 5 cm) at the base of the section (Fig. 2.46). The lahar is overlain by Ogol Lavas (6–10 m thick), but the contact between the two units is not exposed. Presumably unconsolidated ash and other pyroclastic debris, derived from the apron of the active volcano more than 20 km to the northeast, flowed down river channels, picking up trees and woody detritus along the way, and eventually filling the gullies with carbonate and silica rich volcanic sediments containing large pieces of wood. The wood is potentially derived

Fig. 2.45 Noiti 1. Exposure of lahar that has yielded abundant fossil wood. The lahar rests unconformably on the Lower Laetolil Beds. The dark colored blocks scattered over the surface, especially in the background, are boulders of Ogol Lava derived from the top of the ridge



Fig. 2.46 Noiti 1. (a) The figure (Terry Harrison) is standing on the weathered surface of the lahar in the middle part of the section; large boulders of Ogol Lava (dark colored) are present in the foreground derived from the top of the ridge. (b) Close up of the lahar showing the subangular inclusions (*above* and *left* of the penknife) and a large piece of wood *in situ* (to the *right* of the penknife). (c) Weathered surface detritus with fragments of wood (light colored) and boulders and cobbles of Ogol Lava (dark colored)



from trees living on the slopes of the volcano or from those living more locally along the margins of the paleochannels. The abundance of calcite in the lahar confirms a carbonatite source, similar to the Laetolil Beds. The fossil wood and lahar are inferred to be contemporaneous with the Lower Laetolil Beds, since at other locations in the Esere area the same lahar has been observed interbedded within the Lower Laetolil Beds.

Noiti 2 is located about 0.5 km west of Noiti 1, being separated from it by a low, narrow ridge. The fossiliferous exposures are more extensive than at Noiti 1, with a lateral extent of about 300 m (Fig. 2.47). It is situated on the eastern slope of a small river gully that represents a tributary of the Olaitole River. As at Noiti 1, abundant fossil wood has been recovered in association with the same lahar. Some pieces of wood are very large, implying that some trees had trunk diameters in excess of 50 cm.



Fig. 2.47 Noiti 2. View (*northwest*) of the weathered surface of the lahar covered in large blocks of Ogol Lava (dark colored)

Fig. 2.48 Noiti 3. Exposure of the waterlain Lower Laetolil Beds



Noiti 3 represents an extensive outcrop of Lower Laetolil Beds, located 1 km east of Noiti 1. It was first surveyed in 2003. The same suite of sediments occurs at Engesha, 1.5 km to the north. A series of high cliffs on the east side of the Oloosukutan River, a small tributary of the Nasera River, expose a thick series of Lower Laetolil Beds (Fig. 2.48). The sediments are at least 30 m thick, and consist mainly of a series of waterlain yellow and orange tuffaceous silts, sands and gravels, intercalated with primary airfall tuffs and thin horizons of clays. The sediments were apparently deposited in a shallow lake basin. These sediments are capped in the northeast corner of the locality by a lahar, different in composition from that observed at Noiti 1 and 2. This is overlain in turn by Ogot Lavas. A few vertebrate fossils have been recovered, including teeth and a partial elephant skeleton, from the base of the sequence. No aquatic vertebrates have been recovered, so the lake was probably only seasonally inundated. Fossil wood, similar to that at Noiti 1 and 2, also occurs.

Conclusions

Sixty paleontological localities are currently recorded on the Eyasi Plateau, including those at Laetoli. Of these, seven are newly recognized localities in the Laetoli area, and 25 are formally designated here for the first time in the Kakesio and Esere-Noiti areas to the southwest and south of Laetoli respectively. The localities at Laetoli have produced an abundance of fossils of Pliocene age from the Upper Laetolil Beds and Upper Ndolanya Beds, as well as smaller collections of fossil vertebrates and stone artifacts from the Pleistocene Olpiro and Ngaloba Beds. The most productive localities are Locs. 2, 10E and 18, which have each yielded more than 2,000 fossil mammals since 1974.

Fossil hominins are presently known only from localities in the Laetoli area. The Upper Laetolil Beds have yielded the remains of *Australopithecus afarensis*, which represents a relatively rare component of the vertebrate fauna (Su and Harrison 2008). Tracks of fossilized footprints of hominins, presumably of *A. afarensis*, are preserved at Loc. 8 (Footprint Site G). Three new specimens of *A. afarensis* have been recovered from Laetoli since 1998 (EP 162/00; EP 2400/00; EP 2038/03), and the provenience of these specimens is described here. A weathered mandibular fragment (L.H. 29), previously inferred to be derived from Pleistocene deposits at Loc. 8, and attributed to *Homo* cf. *H. erectus*, is considered here to belong to *A. afarensis*. In addition, fossil hominins assigned to *Paranthropus aethiopicus* (EP 1000/98, EP 1500/01) have been recovered from the Upper Ndolanya Beds for the first time. A relatively complete cranium (L.H. 18) of an archaic form of *Homo sapiens* is known from the Upper Ngaloba Beds at Loc. 2. Localities in the Kakesio area and the Esere-Noiti area have yielded relatively small, but important, collections of fossil vertebrates, invertebrates and plants from the Lower Laetolil Beds. No hominins have yet been recovered from this stratigraphic unit, although it is possible that they may be discovered in the future with more intensive collecting and surveying.

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