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OUTLINE OF THE THIRD SEASON, 1984, OF THE PALAEOANTHROPOLOGICAL EXPEDITION TEAM TO THE SAMBURU HILLS AND NACHOLA AREAS, NORTHERN KENYA

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ABSTRACT In 1984, the Osaka University Team (the joint Japan-Kenya Palaeoanthropological Expedition to Samburu Hills, Kenya) conducted geological, palaeontological and anthropological surveys and excavations in the Samburu Hills and Nachola areas, northern Kenya. In this paper, the results of the surveys, excavations and analyses of rocks and fossils are briefly described.

INTRODUCTION

In modern evolutionary anthropology, one of the major objectives is to clarify the origin of hominid lineage with age, place and mechanism. We do not have enough knowledge on the origin of man, however, because of a big information gap of evolution of hominids and hominoids in the Miocene. That is, very few fossils of them are known from the period between 4 and 14 million years ago in Africa. Therefore, it is quite necessary to investigate palaeoanthropological, palaeontological and geological evidence of hominoids from this period, at least.

To fill the gap, the Osaka University team (the joint Japan-Kenya Palaeoanthropological Expedition to Samburu Hills, Kenya) began to conduct anthropological, geological and palaeontological surveys and excavations in the Samburu Hills and Nachola area in northern Kenya in 1980. In the second season (1982), the team discovered fossil specimens of a large hominoid (Samburu Hominoid) of the late Miocene in the Samburu Hills and 22 specimens of *Kenyapithecus* of the middle Miocene in the Nachola area. In the third season of 1984 the team has discovered more than two hundred fossils of middle Miocene hominoids in Nachola area, including a large number of specimens of *Kenyapithecus*.

In this paper, summaries of surveys and excavations, the geology of the Samburu Hills and Nachola area, ages of sediments, palaeontology of Aka Aiteputh and Namurungule Formations in the areas and morphology and phylogeny of the hominoids mentioned above are briefly described and discussed.

GEOLOGICAL SURVEYS

Since 1980, geological surveys have been conducted in the Samburu Hills and Nachola areas.

The main aim of the geological surveys in the third season was to make a geological map along the Baragoi River to make clear the geology in the area between the Samburu Hills and the Nachola area and the relationship between formations in the areas.

On the basis of stratigraphy, the Neogene system in and around the area studied is divided into the following seven formations in ascending order: the Nachola, Aka Aiteputh, Namurungule, Nanyangaten, Kongia, Nagubarat and Tirr Tirr Formations (Sawada *et al.*, 1987; Tateishi, 1987). The Nachola Formation is the lowest part of the Neogene system and unconformably covers the Precambrian basement complex. The Aka Aiteputh Formation conformably overlies the Nachola Formation and occurs in the areas, consisting of basalts and sediments. The Namurungule Formation consists chiefly of clastic sediments and covers the Aka Aiteputh Formation. The Nanyangaten Formation consisting of basalt lava flows unconformably covers the Nachola and Aka Aiteputh Formation. In 1982 survey, we concluded the horizon of *Kenyapithecus* was the Nachola Formation. But detailed survey showed that the horizon belongs to the Aka Aiteputh Formation.

ANTHROPOLOGICAL EXCAVATIONS

In the third season, the excavation at Site 22, in which a large hominoid had been discovered, was continued. The main work of the season was to remove the sediments covering the hominoid horizon. After two months' work, one fifth of the sediments were removed, and digging of fossils was conducted on the west terrace. A large canine of carnivore and many fragmental bones were recovered from the hominoid horizon, but no hominoid fossils were unearthed from Site 22 (Yasui *et al.*, 1987).

On the other hand, from fossil sites in the Nachola area, especially from Site BG-X, many isolated teeth and fragments of jaws and postcranial bones of primates, especially of *Kenyapithecus*, were discovered by excavation and screening. In total the number of specimens of primates reached 222 specimens, and that of *Kenyapithecus* reached 168 specimens including specimens from other sites in Nachola area. The dry sieving was quite effective with many ladies of the Turkana.

We dug fossils at the Site BG-1, in which we discovered the most complete specimen of *Kenyapithecus* ever found, on a day at the end of the expedition. After one day digging there, we obtained 2 more isolated teeth.

PALAEONTOLOGICAL SURVEYS

Palaeontological surveys were carried out in two areas. One was on the sediments south of Site 22, the other was in the Nachola area. As for the former, twenty fossil sites were discovered and a number of large mammalian fossils were collected. The fauna is characterized by hipparions, small and large type hipparions. The kind of fauna is called as "Post *Hipparion* Fauna" (Nakaya, 1987).

In the Nachola area, we could not find any specimens of *Hipparion*, but some old type of

Gomphoheriidae. The fauna is "Pre-*Hipparion* Fauna" and the age seems to be around 15 Ma on the basis of biostratigraphy (Pickford *et al.*, 1987; Pickford, 1987). With fossil primates, a great number of bone and scute fragments of aquatic reptiles were found. The proportion of the number of specimens of mammals to the fauna except for primates was quite low.

The fossil specimens collected in the field have been stored in the National Museums of Kenya in Nairobi, Kenya. Therefore, the studies on the original specimens have been conducted in the summer of 1985 and spring of 1986 in Nairobi. The analyses of the fossil woods were done in Kanazawa University and Kyoto University (Suzuki, 1987; Ishiaa, 1987). A genus of fossil wood was identified as *Croton* sp.

DATING BY K-AR METHOD AND PALAEOMAGNETISM

For the K-Ar and palaeomagnetic dating of the sediments, nearly one ton of rocks were collected in the field and shipped to Japan. The K-Ar dating was done in Okayama University of Science and the palaeomagnetism of rocks were measured in Fukui University (Itaya & Sawada, 1987; Nakajima & Torii, 1987).

From the datings of K-Ar and palaeomagnetism, the age of *Kenyapithecus* is between 15.4 and 12.8 Ma, and that of the Samburu hominoid horizon is geochronologically between 10.7 and 7.4 Ma. Combining with the biostratigraphical data, *Kenyapithecus* might be around 15 Ma and the Samburu hominoid around 9 Ma.

The age of the Aka Aiteputh Formation seem to be correct, but the range of the age of the Namurungule Formation is so wide that we need to check the date with more materials for palaeomagnetism and fission-track methods in future.

GEOSTRUCTURE AND TECTONIC MOVEMENTS

An extremely marked structural gap between the Namurungule and Nanyangaten Formations is recognized by the geological and geochronological data that there are many faults in the Nachola, Aka Aiteputh and Namurungule Formation but few in the formations above the Nanyangaten Formation. The faults in the lower three formations indicate a major tectonic movement of the rift system between 10 to 7 Ma (Sawada *et al.*, 1987; Itaya & Sawada, 1987).

The Namurungule Formation consists chiefly of clastic sediments with intercalations of mud flow deposits and tuff, but a poor lava flow is seen there. This means that the volcanic activities were rather weak during the process of deposition of the Namurungule Formation, when the Samburu Hominoid was living. However, the period of *Kenyapithecus* shows considerably higher volcanic activities as do the Nachola Formation and the formations above the Nanyangaten Formation (Sawada *et al.*, 1987).

FOSSIL PRIMATES

222 fossil specimens of primates were discovered in the Nachola area, among them more than three groups are identified. One of them is a member of cercopithecoids and may be a species of *Victoriapithecus*. The other two are hominoids including *Kenyapithecus*. The number of specimens of *Kenyapithecus* is more than 168, which is two third *Kenyapithecus* specimens discovered so far in the world. Some canines of *Kenyapithecus* are quite large. It is very difficult to reconstruct U-shaped dental arch using right and left upper jaw fragments from the Site BG-I. A fragment of the right mandible from the same individual is robust like that of a female orang-utan. It shows that the *Kenyapithecus*' gnathic organ might be quite strong with thick enamel in the cheek teeth.

DISCUSSION

It has become clear that the area (about 900 km^2) studied has many variously aged sediments in the Neogene from about 18 to 0.6 Ma. This means that the area may be a fascinating spot for study of origin and evolution of hominids and hominoids. It seems possible to discover many fossils of them belonging to different periods if we continue our excavations in these areas.

In and around the BG-X sites, a number of fossil wood were collected. The species of them are not divergent but seem to be belonging to a same group, *Croton* sp. which are seen in the White Highland and around Nairobi.

The faunae and florae of Samburu Hills and Nachola show that the palaeoenvironment of *Kenyapithecus* might be a thick forest with rich water, but that of the Samburu hominoid woodland -savanna. Fossil snails may help us to understand the palaeoenvironments of the hominoids.

The detailed analysis of the specimens of *Kenyapithecus* may clarify the degree of sexual dimorphism of the species and the divergence of the group. By the analyses of the morphology of the mandible and maxilla, it is very difficult to classify *Kenyapithecus* in hominids. But the study of this group may help to give important information on the evolution of living African apes and man. It is quite necessary to study the evolution of *Kenyapithecus* before approaching the problems of hominid origins directly. The sub-nasal morphology of the maxilla of *Kenyapithecus* from Nachola suggests that *Kenyapithecus* is quite different from its contemporary Asian *Ramapithecus* while the former is similar to *Australopithecus*, living African apes and man, and the latter is to orang-utan.

In the third season, we could not get any fossil specimen of primates from the Samburu Hills. This does not mean the low potential of the site, because our major work in the season was to remove the sediments covering the hominoid horizon. After several seasons, whole surfaces of the horizon will be exposed. The large hominoid from the Site 22 is still keeping the highest status of the late Miocene hominoid specimen in Africa. However, we need more materials of the hominoid to discuss the phylogenetic position and origin of hominids.

CONCLUSION

In the Samburu Hills and Nachola areas, there are 7 Neogene formations from 18 Ma to Recent. Aka Aiteputh Formation (*Kenyapithecus*-pre *Hipparion* stage) belongs to the middle Miocene and Numurungule Formation (Samburu Hominoid-post *Hipparion* stage) to the late Miocene. Detailed study of *Kenyapithecus* and a continuation of the excavations in Site 22 are very essential to approach the problems of the origin of hominids.

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