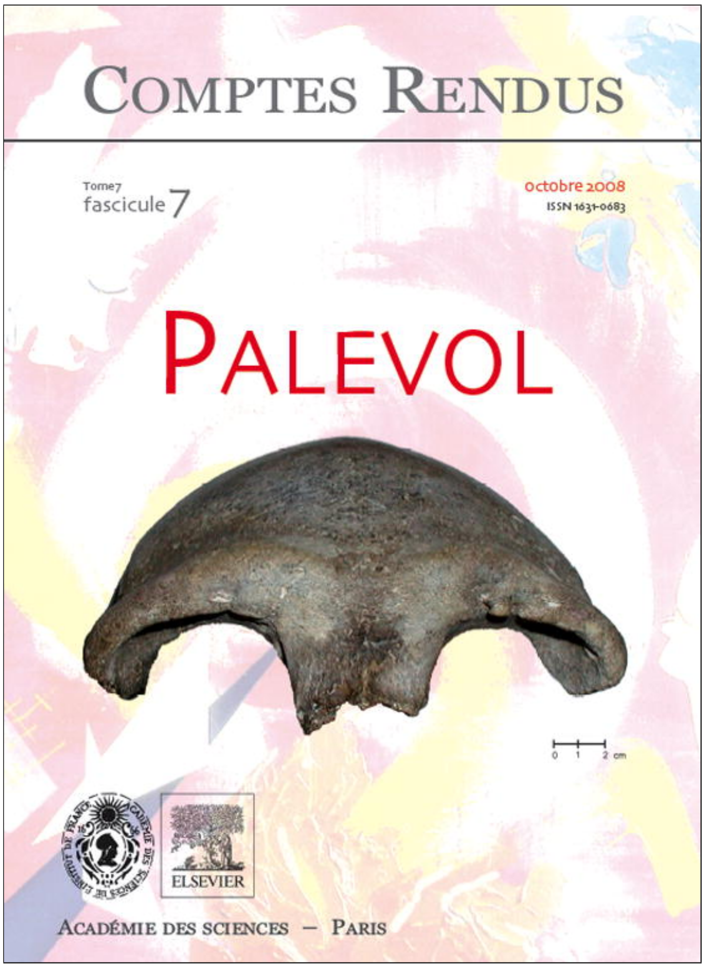
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Human palaeontology and prehistory

New palaeoanthropological research in the Plio-Pleistocene Omo Group, Lower Omo Valley, SNNPR (Southern Nations, Nationalities and People Regions), Ethiopia

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Abstract

Through previous works in the early 1930s by C. Arambourg and in the 1960–1970s by the International Omo Research Expedition (IORE) initiated by F. C. Howell, the Omo Group deposits of the Lower Omo Valley provided decisive data on Plio-Pleistocene environmental change and hominid evolution in eastern Africa. Y. Coppens directed the IORE French component with Arambourg, then alone from 1970 to 1976. After 30-year hiatus, the Omo Group Research Expedition reinitiated field work on Shungura Formation deposits aged between 3 Ma and 2 Ma. In 2006 and 2007, renewed methods led to the collection of more than 600 vertebrate specimens with a particularly precise record of contextual data. These specimens include significant hominid remains dated to 2.5 Ma and slightly older. Changes in faunal distributions were also recorded. Additionally, the Shungura Formation archaeological record is reconsidered. These first results are indicative of future advances in the study of biodiversity evolution and its relationship with global and regional environmental changes. ***To cite this article: J.-R. Boisserie et al., C. R. Palevol 7 (2008).***

Résumé

Nouvelles recherches paléoanthropologiques dans le Groupe Omo, Plio-Pléistocène, basse vallée de l'Omo, SNNPR (Southern Nations, Nationalities and People Regions), Éthiopie. Les travaux menés par C. Arambourg (1932–1933) et les Expéditions

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Internationales de l'Omo (IORE) initiées par F. C. Howell (1967–1976) ont placé les dépôts du Groupe Omo au cœur des recherches sur l'évolution des hominidés et des environnements plio-pléistocènes. Y. Coppens dirigea l'équipe française avec C. Arambourg, puis seul de 1970 à 1976. Après 30 années de « jachère », les Expéditions de Recherche dans le Groupe Omo ont repris les travaux sur les dépôts de la Formation de Shungura. En 2006 et 2007, de nouvelles méthodes ont permis de collecter plus de 600 fossiles de vertébrés, avec des données contextuelles particulièrement détaillées. Ces fossiles incluent des restes d'hominidés datés entre 2,5 Ma et 3,0 Ma. Des modifications dans la composition des faunes ont été observées entre membres. Une révision du registre archéologique de la formation de Shungura a été entamée. Ces premiers résultats permettent d'envisager de prochaines avancées sur les liens entre évolution de la biodiversité et changements globaux et régionaux. ***Pour citer cet article : J.-R. Boisserie et al., C. R. Palevol 7 (2008).***

Keywords: Fossil vertebrates; Hominids; Early Stone Age; Field work; Late Pliocene; Shungura Formation; Eastern Africa

Mots clés : Vertébrés fossiles ; Hominidés ; Paléolithique ancien ; Travaux de terrain ; Pliocène récent ; Formation de Shungura ; Afrique orientale

1. Introduction

The Omo Group Research Expedition, an international multidisciplinary team, was created in 2006 to reinitiate palaeoanthropological field work on the Omo Group sediments found in the Lower Omo Valley, southwestern Ethiopia (Fig. 1). These sediments range from Early Pliocene to Early Pleistocene, and belong to the Mursi Formation, the Usno Formation, and the Shungura Formation. After a 30-year-period without fossil collection, the new research team has been working in the Shungura Formation for the last two years. This paper presents the context, goals, and 2006–2007 general results of this research.

2. Camille Arambourg (1885–1969) and F. Clark Howell (1925–2007): setting up palaeoanthropological standards in the Lower Omo Valley

Beyond the scientific significance of its fossils and artefacts discovered during the 20th century, the Omo Group deposits of the Lower Omo Valley, notably the Shungura Formation, feature prominently in the history of research on human evolution. It was one of the first palaeoanthropological research areas known in eastern Africa, and was exploited by a diversity of teams with a correlated diversity of methods, goals, and theoretical frameworks. Guillemot [26] provided a detailed historical account on this research. C. Arambourg and F. Clark Howell were decisive contributors to these previous studies.

The French palaeontologist Arambourg was initially drawn to the Lower Omo Valley by fossils collected from there in 1902 during the trans-African expedition of du Bourg de Bozas. Arambourg conducted a field expedition through Kenya and worked mostly on the

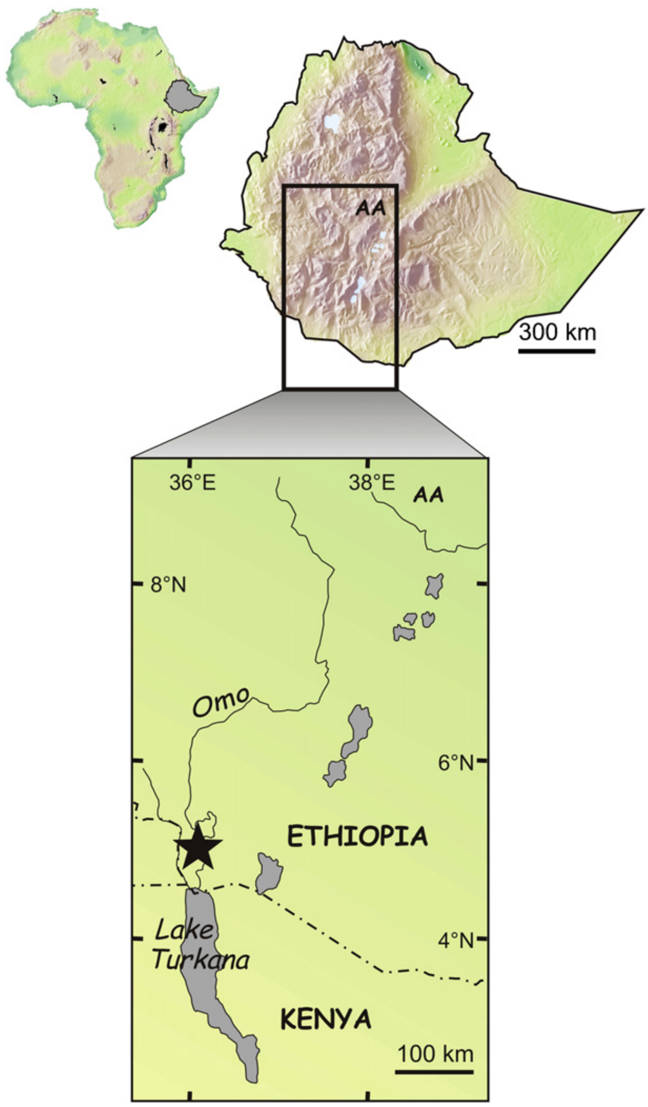

Fig. 1. Spatial location of the Shungura Formation, Lower Omo Valley, Ethiopia. AA: Addis Ababa; star: Shungura Formation.
Position géographique de la formation de Shungura, basse vallée de l'Omo, Éthiopie. AA : Addis Abeba ; étoile : formation de Shungura.

southern part of the Lower Omo fossiliferous deposits from January to March 1933. He recognized the Plio-Pleistocene age of these localities and broadly described their stratigraphy and sedimentology [6]. Arambourg sampled an abundant collection of fossil vertebrates that were brought back and studied at the National Museum of Natural History (Paris, France). In this material, he recognized a number of new taxa of bovids, hippopotamids, and proboscideans described in numerous publications in the 1930s and the 1940s [e.g. 3–5, 7, 8]. This contribution illustrates well Arambourg's lifetime research, which critically augmented knowledge of Plio-Pleistocene African faunas. In 1967, Arambourg formed, with Howell (USA) and L. S. B. Leakey (Kenya), the second major research expedition in the Omo Valley. Arambourg co-led the French contingent with Y. Coppens. Together, they described a new species of hominid found in the Shungura Formation and dated to around 2.5 Ma: *Australopithecus aethiopicus* (Arambourg and Coppens, 1967) [9]. Until his death at age 84, Arambourg participated to the field missions in southwestern Ethiopia. Coppens became the sole leader of the French team in 1970, and co-directed the IORE with Howell until 1976.

If Arambourg led the way to important fossil discoveries in the Lower Omo Valley, the work of F. Clark Howell was decisive in a methodological dimension and had a particularly wide impact on the whole field of palaeoanthropology. His first research in the Omo Valley was conducted in 1959. This short expedition led to the formation of the International Omo Research Expedition (IORE) including American, French, and Kenyan scientists. The multidisciplinary teams (including notably geologists, radiochronologists, palaeontologists, palynologists, archaeologists, anthropologists) conducted fieldwork for a duration of nine years between 1967 and 1976. The IORE work was marked by the ability of Howell to work at the interface of all disciplines related to human evolutionary studies, from tectonics to artefact technology. He also understood fully the potential of newly developed methods, such as radiochronology, and quickly incorporated them. Consequently, the Shungura Formation, sampled at hundreds of localities, was divided into 111 stratigraphic units precisely described [28], with more than 25 marker levels dated by absolute methods or by estimation between ca. 3.6 Ma and ca 1.05 Ma [24]. In this particularly accurate chronostratigraphic framework, vertebrate evolution was recorded by way of around 50,000 specimens representing more than 150 species [20], including at least four hominid species [30]. The Shungura Formation also provided important data on environmental and cultural evolution [e.g. 31]. Howell aimed at understanding hominid evolution within its temporal, environmental, cultural, structural, and climatic context. He succeeded in widely spreading this integrative vision. The IORE work in the Shungura Formation became a reference for later palaeoanthropological research in Africa and led UNESCO to add the Lower Omo Valley on the World Heritage list in 1980.

3. The Omo Group Research Expedition

3.1. Resuming field work in the Omo Group deposits: rationale

Since the 1980s, palaeoanthropological research experienced considerable advances. New species were discovered from Middle to Early Pliocene [16,34,33,46] and from the Latest Miocene [15,27,39]. This new data shed light on the earliest moments of hominid evolution, closely after the point of divergence of the hominid lineage from that leading to *Pan*. Comparatively, questions related to evolutionary events at another critical time period – between 3.0 Ma and 2.0 Ma – made little progress.

During the 3-2 million year window, significant and crucial events in human evolution took place. They were first described and theorized by Coppens as the "(H)Omo Event" [18,19]. This time period marks the transition from *Australopithecus* to *Homo* and the appearance of the robust *Australopithecus* species, sometimes placed in the genus *Paranthropus*. These intermediate steps have to be better documented. Known evidence mostly derives from relatively incomplete and/or stratigraphically uncertain remains, with the exception of two species. *Australopithecus garhi* from the Awash Basin, dated at 2.5 Ma [10], exhibits significant megadontia but no clear evidence of an exclusive relationship with the robust species of *Australopithecus*. Its possible close relationship with *Homo* also needs to be confirmed. *A. garhi* was subcontemporaneous to the robust *Australopithecus aethiopicus*, dated between 2.5 Ma and 2.3 Ma [44]. Until now, this robust species was only found in the Turkana Basin, not in the Awash Basin. If this possible example of geographic exclusion between *A. garhi* and *A. aethiopicus* was to be confirmed, its significance should be carefully considered.

Second, increasingly old behavioural evidence of significant diversity [21,29,36,38] paradoxically suggests that we still miss technological developments earlier than 2.6 Ma. In addition, the identity of the earliest hominid toolmakers remains elusive as the earliest stone tool assemblages cannot be definitively attributed to any one in particular of the known Late Pliocene hominid lineages.

Third, an abundant literature proposes that climatic changes taking between 3.0 Ma and 2.0 Ma had a determining affect on hominid evolution [e.g. 20,22,23,42,43]. This period of time was characterized by global cooling, expansion of sea ice sheets, increased seasonality at lower latitudes, and the establishment of 41 Ka climatic cycles. However, faunal evolution undoubtedly also responded directly to regional and local factors (tectonics, hydrography, ecosystem dynamics) and intrinsic factors (dispersal and population dynamics, interspecific interactions). The role, interaction, and level of action for each factor still need to be determined. Additionally, studies of the interplay between environmental changes and faunal evolution are highly sensitive to the quality of the fossil record being considered. Answers can vary according to the geographical, temporal, and ecological resolution used to address such questions.

The Omo fossil record, in its chronological span and completeness, can best address these complex issues [e.g. 1,14]. African Upper Pliocene deposits often exhibit limited spatial extension and significant chronological gaps, but this is not the case for a large part of the Omo Group deposits in the Lower Omo Valley. These include, within the Shungura Formation, particularly extensive and continuous deposits dating between 3.0 Ma and 2.0 Ma. The Omo fossil record is therefore a powerful tool for investigating how Late Pliocene faunas evolved in the northern Turkana Basin, enabling to interpret this evolution in terms of possible environmental changes.

Despite early intensive research, the potential of the Shungura formation was by no means exhausted during the 1960s–1970s. This is shown by the discovery of many new localities, important hominid remains [2], and previously unsampled taxa during the last IORE field mission (1976). Moreover, monitoring of fossil content renewal in similar deposits [45] provide grounds to suggest that, despite probably slow rates of renewal, a significant number of well-preserved specimens should have been unearthed during the last 30 years.

3.2. A renewed approach

In light of the issues above detailed, the Omo Group Research Expedition has six basic goals.

- *(1) Linking fossils to detailed contextual data.* Except for delimited excavations, previous collections listed locality numbers as the most precise location reference. Some localities, such as OMO 75, are hundreds of thousands of square meters. Many include several units (submembers): sometimes as much as 10 units, or up to a 70 m-thick recomposed section. Ten large localities regroup one third of the specimens collected in the Shungura Formation. New fossil collection by the Omo Group Research Expedition re-associates this fossil biodiversity data with more precise geographic, stratigraphic, sedimentological, and taphonomical context.
- *(2) Revising the faunal record.* Eighty-six percent of specimens from the previous Omo collections were taxonomically attributed before 1978 and do not take into account changes in taxonomy and systematics of the last three decades. Furthermore, about 50% of the previously collected specimens were not identified below the level of family. New field and analyses work aims to revise and augment the taxonomic assignments and interpretations made to the Omo collections, both existing and new.
- *(3) Obtaining original, well-constrained palaeoecological data.* Ecological needs and characteristics of fossil species are often assumed to have been similar to those of their closest extant relatives. Independent methods in palaeoecology (biogeochemistry, dental wear analyses, morphofunctional analyses) have shown that lineages may vary in diet and habitats through time. Such analyses, once applied to the Omo Group faunal record of the Lower Omo Valley, will play a major role in supporting or altering hypotheses of ecological evolution.
- *(4) Associating sedimentary facies to depositional environments.* The broad work done by the IORE on stratigraphy and tectonics enables detailed sedimentological analyses. Identification of the occurrences and nature of depositional environments will allow the reconstruction of habitats throughout the Omo Group sequence, providing an environmental record that is both independent of and complementary to that provided by the biological markers themselves.

On this ground, the Omo Group Research Expedition targets particularly the reconstruction of wet habitat ecosystems. Wet habitats concentrate important resources for large segments of tropical faunas, and this no doubt included extinct hominid species. These habitats may have played an important role in hominid dispersal [11,32], especially on a continent marked by a succession of contractions and extensions of arid areas at least since the Late Miocene [37,40]. The evolution of these habitats and associated faunal communities in the northern Turkana Basin will also be explored by correlating data derived from analysis of both sedimentary facies and wet habitat biological markers. Resulting interpretations will then be assessed within the broader regional and continental contexts.

- *(5) Increasing data on hominid behavioural evolution.* The Omo Group deposits of the Lower Omo Valley possess significant potential for elucidating the earliest phases of cultural evolution. Renewed field work efforts notably concentrate on archaeological occurrences older than 2.0 Ma, with the reinterpretation of previous collections and the discovery of new materials.
- *(6) Assessing the impact of economic development and tourism on Ethiopian antiquities.* The Omo Group Research Expedition was established to meet Ethiopian authority conservation plans. 'Palaeotourism' is a potential source of income for Ethiopia, but any future implementation first requests detailed assessments of threats in terms of the conservation of fossil localities. The new field work contributes to this task by producing an inventory of the precise location and conservation status of the Omo Group Formation localities.

4. Field missions and preliminary results for 2006–2007

4.1. Methodology

Field work was conducted for two weeks in July 2006 and two weeks in June 2007 in the Shungura Formation. Access to the formation was made extremely difficult by poor road conditions. These first missions, including 15 to 18 members, focused on palaeontological survey and collection. The following array of methods is used by the Omo Group Research Expedition: controlled group survey on predefined areas according to geological context; 'crawling' surveys on localized areas with particular fossil content [45]; limited excavation for partially unearthed specimens; limited sieving for retrieval of specimen fragments (Fig. 2). During surveys, discovered specimens are flagged and left untouched until they are examined by survey leaders. This allows: (1) a full control of the sampling; (2) retrieving the full set of contextual data available for each specimen. These data include GPS location (average accuracy = 10 m), stratigraphic placement (intrabed position), surrounding sedimentology, taphonomic information, as well as a record of conservation actions (e.g. chemical consolidation). Fossil sampling is selective during controlled group surveys: the nature and number of specimens collected from the field is determined by both the overall scientific significance as well as the particular context of discovery of individual fossils.

All collected specimens are prepared, studied, and stored at the National Museum of Ethiopia located in Addis Ababa. They receive inventory numbers built on the following model:

[locality identifier] [locality number]/[locality subnumber if required]-[specimen number].

Examples: OMO 18/sup-10025; L 293-10001; OMO 333-10003.

Whereas old localities were identified by a range of letters or group of letters (L, P, F, OMO), all new localities are indicated solely by the identifier 'OMO' and locality numbering follows from the last IORE 'OMO' number (OMO 327). Newly collected specimens from both old and new localities are numbered starting from 10001. This avoids any possible confusion with IORE collections where the highest specimen number reached 9089. Unlike the case of previous French IORE collections, the year of discovery is not included within the number and the specimen numbers are incremented independently from year changes. Taking collection years into account within inventory numbers greatly elongates the numbers for no significant advantage, and has furthermore proved to be a constant source of curatorial error.

All inventory and contextual data are stored in a newly developed relational database built for integrating previous computerized catalogues. This database follows the Revealing Hominid Origins Initiative database template [12].

4.2. Provisional faunal list and fossil abundances

In 2006–2007, a total of 27 localities were surveyed, all located in the southern part of the type area of the Shungura Formation, essentially the area where the IORE French team worked. In these localities, 639 fossil specimens identifiable to the genus level were collected. A few localities were surveyed in Members D (OMO 119, OMO 120) and G (OMO 310, OMO 323, OMO 330), but the majority of sampled localities were located in Members C and B (Fig. 3), dating between 2.52 Ma and 2.95 Ma [24].

Seven new localities were defined, either to delimit more precisely fossil accumulation areas within larger localities (OMO 329 within OMO 56sup), or to inventory previously uncollected loci. In terms of fossil content conservation and renewal, three categories of localities were identified.

The first category concerns localities heavily collected by the IORE, such as OMO 18, which appeared

Fig. 2. Field work methods used during the 2006–2007 field seasons, Shungura Formation, Lower Omo Valley, Ethiopia. A: controlled survey and specimen flagging; B: localized excavation; C: 'crawling'; D: sieving operation.
Méthodes de terrain employées pendant les missions 2006–2007, formation de Shungura, basse vallée de l'Omo, Éthiopie. A : prospection contrôlée et signalisation des spécimens ; B : extraction ; C : prospection fine ou « crawling » ; D : opération de tamisage.

much depleted compared to the initial content found by the IORE. At OMO 18, surveyed in 2007 by 10 people during three days, first estimates corrected according to sampling methods (by applying 2007 selectiveness to the IORE fossil record) indicate a renewal rate of about 11%. In other words, for a given category of elements from a given family collected by both IORE and Omo Group Research Expedition, the IORE sample is on average 9.1 times larger than that collected by the Omo Group Research Expedition. It is difficult to estimate differences in sampling efficiencies of previous and new field campaigns. If these differences are negligible, the renewal rate indicated here appears relatively important compared to expectations [14], and it is for now underestimated, as the IORE collection was conducted on a seven year period by a larger team. New specimens are generally smaller than the average IORE OMO 18 specimen-size, indicating a sampling bias and/or a faster renewal of small fossil content.

The second category of locality comprises IORE localities where 2006–2007 surveys found many more fossils than during the whole IORE operations. This was the case for localities immediately adjacent to first category localities, as for OMO 18/sup, located in the same catchment as OMO 18. In 2007, comparable amounts of fossils were collected in both localities (i.e., 63 specimens in OMO 18/sup versus 78 specimens in OMO 18) whereas the IORE found about 35 times more specimens in OMO 18 than in OMO 18/sup.

The third category includes previously non-inventoried localities found outside previous localities. Until now, these new localities are limited in size and do not contain large amount of fossils. These features indicate that, in the surveyed area, the IORE identified most fossil concentrations, but apparently focused its efforts on the richest of these concentrations.

Detailed examination of the collected fauna is currently in progress, but preliminary study of the 2006–2007 specimens enabled a combined faunal list for Member B and Member C (Table 1). In the new collection considered as a whole (members B, C, D, and G), cercopithecids are the most abundant taxon (291 specimens). They are dominated by the genus *Theropithecus* represented by numerous isolated teeth but also subcomplete crania, mandibles, and postcranial bones. Less frequent and mostly represented by isolated teeth, are a minimum of four other cercopithecids, including a Papionini and three Colobinae (Table 1).

Cercopithecids are followed in relative abundance by bovids (120 specimens). Tragelaphini are dominant in

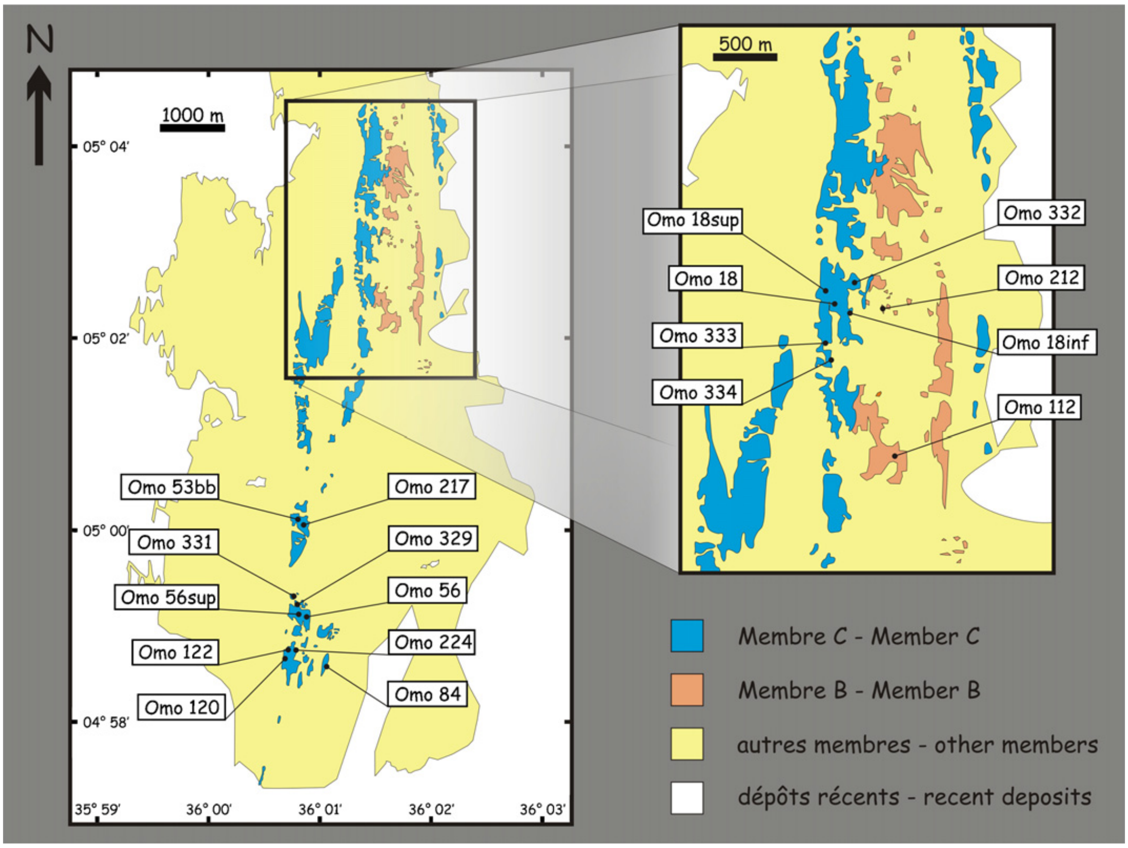

Fig. 3. Spatial location of Member C and Member B localities surveyed in 2006 and 2007 in the southern part of the Shungura Formation type area. Fossil hominid localities are: OMO 18inf, OMO 84, OMO 224, OMO 329, OMO 333. OMO 112 includes four localities: OMO 112/1, OMO 112/2, OMO 112/3, and OMO 112/4. Recent deposits include Middle to Upper Pleistocene and Holocene sediments.
Position géographique des localités des membres B et C prospectées en 2006 et 2007 dans la partie de l'aire type de la Formation de Shungura. Les localités à hominidés sont : OMO 18inf, OMO 84, OMO 224, OMO 329, OMO 333. OMO 112 inclut quatre localités : OMO 112/1, OMO 112/2, OMO 112/3, et OMO 112/4. Les dépôts récents contiennent des sédiments du Pléistocène moyen et supérieur et de l'Holocène.

all members, but Reduncini, infrequent in Members B and C, are abundant in Member G.

Suids are also common (86 specimens) and relatively diverse. Tetraconodontinae are well represented, notably in Member B with *Notochoerus* cf. *euilus* and *Nyanzachoerus* sp... In Member C, these taxa are replaced by *Notochoerus* cf. *scotti* and a greater proportion of Suinae, including *Kolpochoerus* cf. *limnetes* and early *Metridiochoerus*.

Hippopotamids constitute the fourth most common group (60 specimens). The collected material should allow pinpointing precisely the transition between hexaprotodont and tetraprotodont forms of aff. *Hippopotamus protamphibius* (identified as *Hexaprotodon protamphibius turkanensis* and *Hexaprotodon protamphibius protamphibius* respectively by Gèze [25]). The transition between a hexaprotodont morphotype and a tetraprotodont morphotype was clearly not contemporaneous in the Turkana Basin and in the Awash Basin. In Member G, some specimens should help clarifying the relations between aff. *Hippopotamus protamphibius*, aff. *Hippopotamus aethiopicus*, and aff. *Hippopotamus karumensis*.

Five new hominid specimens were discovered in five different localities of Member C, and can be dated from 2.74 Ma to 2.58 Ma. This proportion of specimens fits expectations based on IORE collections. This sample includes: two upper molar crowns, one complete (OMO 84-10001) and one fragmentary (OMO 18/inf-10022); two complete lower molar crowns (OMO 224-10005 and OMO 329-10015); one edentulous mandible with preserved symphyseal area and partial left and right corpora (OMO 333-10003). The molar cusp pattern is simple, with no or few additional cusps/ids. A preliminary examination excludes the interpretation that this material belongs to new taxa. These teeth can be attributed to two different taxa: the lower molars belong to a form belonging or close to genus *Homo*; the upper molars are indicative of a 'robust' form noted cf. *Australopithecus aethiopicus*. The mandible OMO 333-10003 could be

Table 1
Faunal list for Member B and C localities sampled by the Omo Group Research Expedition in 2006–2007
Liste faunique pour les localités du membre C échantillonnées par l'Omo Group Research Expedition en 2006–2007

Mammalia
Rodentia
Hystricidae sp.[b]
Carnivora
Felidae sp.[b]
Hyaenidae sp.[b]
Mustelidae[b]
cf. Lutrinae[b]
cf. Viverridae[b]
Primates
Cercopithecidae
Papionini sp. ('large')
Colobinae sp.[a]
Colobinae 'large'[b]
Colobinae 'medium'[b]
Colobinae 'small'[b]
Theropithecus sp.
Hominidae
cf. *Homo* sp.[b]
cf. *Australopithecus aethiopicus*[b]
Australopithecus aethiopicus[b]
Cetartiodactyla
Suidae
Nyanzachoerus sp.[a]
Notochoerus cf. *euilus*[a]
Notochoerus cf. *scotti*[b]
Notochoerus sp.
Kolpochoerus cf. *limnetes*
Metridiochoerus sp.[b]
Hippopotamidae
aff. *Hippopotamus* cf. *protamphibius*[a]
aff. *Hippopotamus protamphibius*[b]
Hippopotamidae sp.
Bovidae
Aepyceros sp.[b]
Bovini sp.[b]
Tragelaphus nakuae
Tragelaphus sp.[a]
Reduncini sp.[b]
Kobus sp.
Giraffidae
Giraffa sp.[b]
Giraffa cf. *pygmaeus*[b]
Perissodactyla
Equidae
Hipparionini sp.
Rhinocerotidae
cf. *Ceratotherium*
Proboscidea
Elephantidae
Elephas cf. *recki*
Deinotheriidae
Deinotherium bozasi[b]

[a] Taxa found in Member B only; no [a]: taxa found in Members B and C.
[a]Taxons collectés uniquement dans le membre B ; absence de [a] : taxons collectés dans les membres B et C.
[b] Taxa found in Member C only.
[b]Taxons collectés uniquement dans le membre C.

that of a senile individual, as the loss of teeth probably occurred before death. Certain morphological features of this mandible (symphyseal shape, corpus width) are in agreement with an attribution to *A. aethiopicus*. *A. aethiopicus* being not extensively documented, OMO 333-10003 should help enlightening morphological variability within this species in relation to various factors, notably ageing.

Faunal distributions exhibit some differences between the different members (Fig. 4). Cercopithecids are predominant in both Members B and C, but these members differ in the frequency of suids, higher in B than in C. Member G exhibits a different pattern, with a predominance of bovids over suids, cercopithecids being only 16% of the collected specimens. This overall pattern fits well what was previously described for the French IORE collections [1].

4.3. Archaeology

A preliminary reassessment of the existing archaeological evidence collected by the IORE and stored at the National Museum of Ethiopia was conducted by A. Delagnes in collaboration with Y. Beyene. This examination included published material from OMO 71, OMO 84, OMO 57, and OMO 123 [17], as well as unpublished series, mostly collected in 1976 from members E and F (dated between 2.40 Ma and 2.33 Ma).

Re-examination focused on a technological diagnosis of all the series, complemented by a quantitative analysis of the in situ material from the two largest series: OMO 123 (member F, 266 lithic remains) and OMO 84 (Member E, 161 lithic remains). The recorded data includes, for each category of product (flakes, fragments of flakes, undetermined fragments <1 cm, chunks, cores): raw material characterization, cortex extension (recorded by 25% classes) and size attributes. This preliminary analysis confirms the general features of the Omo assemblages, initially documented by Chavaillon [17] and Merrick & Merrick [35], which are: the dominance of quartz as raw material, the very small size of most artefacts, the abundance of chunks (or angular fragments), the scarcity or lack of clearly diagnostic elements such as nuclei and retouched tools, the abundance of split fractures and shattered platforms on the flakes, which could be indicative of a bipolar percussion technique. Such expedient production is associated with a more elaborated component, consisting in rare and very small chert flakes with numerous multidirectional negatives of removals, in OMO 71, OMO 84 (member E), OMO 57 and OMO 123 (member F) in situ series, and discoidal-like quartz cores, already described by de

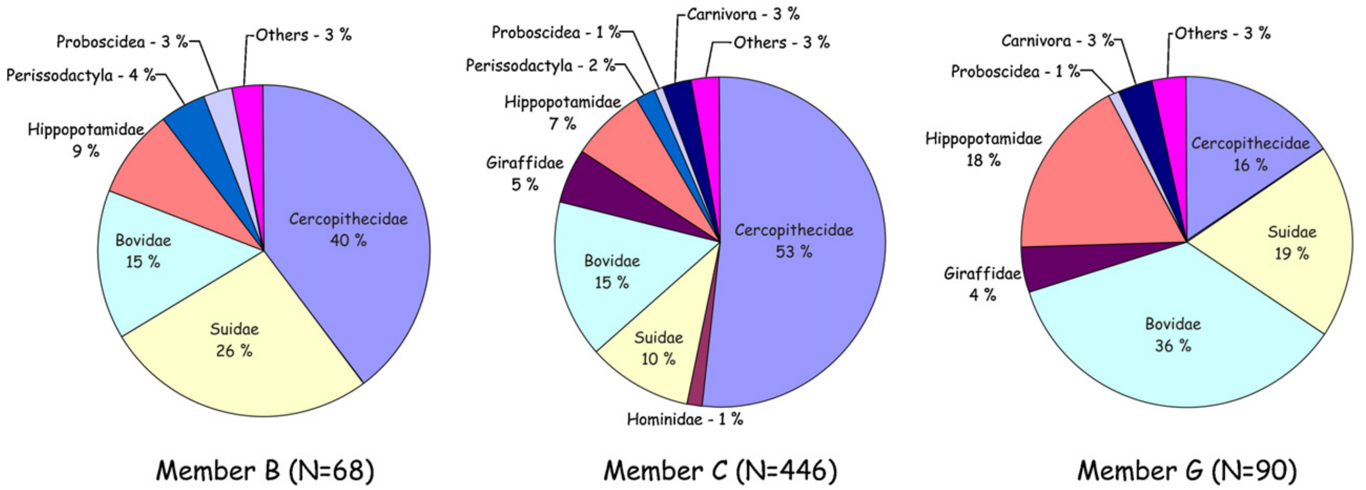

Fig. 4. 2006–2007 specimen distribution by higher rank taxa in Members B, C, and G.
Distribution par taxons de rangs supérieurs des spécimens collectés en 2006–2007 dans les membres B, C et G.

la Torre [41], in OMO 57 surface collection. The contemporaneity of this more elaborated component with the rest of the lithic assemblage has yet to be established.

All this implies that a technological reinterpretation of these series should not be conducted without detailed contextual assessment of the sites from which they derive. This assessment should include: (1) taphonomy of archaeological occurrences (impact of fluviatile dynamics on site formation processes, extent of postdepositional processes, i.e. argiliturbation or bioturbation); (2) location and petrographic characteristic of the raw material potential sources; (3) physical and mechanical assessment of the Lower Omo Valley quartz properties with regard to knapping. These aspects, largely neglected in previous works, will guide future archaeological work in the Shungura Formation.

5. Prospects

The work of the Omo Group Research Expedition will be intensified during the next field seasons. Paleontological surveys will be extended to the complete sequence of the Omo Group deposits in the Lower Omo Valley (including Usno and Mursi Formations). Revision of the stratigraphy is required for a number of localities in the Shungura Formation [e.g. 13], and detailed sedimentological analyses will be performed on significant paleontological localities. Finally, archaeological work will include a reassessment of the stratigraphic position of the known occurrences and extensive survey of members situated below and above published occurrences (i.e. between 3.0 Ma and 2.0 Ma).

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