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# Is there a Developed Oldowan A at Olduvai Gorge? A diachronic analysis of the Oldowan in Bed I and Lower-Middle Bed II at Olduvai Gorge, Tanzania

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## ABSTRACT

Debates regarding the validity of the Developed Oldowan as separate cultural facies within the Oldowan techno-complex have primarily concentrated on the Developed Oldowan B/Acheulean transition, with little attention paid to the validity of the Developed Oldowan A (DOA) as a valid technological differentiation. This study presents a diachronic technological analysis and comparison of Oldowan and DOA lithic assemblages from Olduvai Gorge, Tanzania, dated between 1.84 and 1.6 Ma, to test the validity of Leakey's original distinction between these two cultural facies. The results from this comparative analysis show very few technological differences between the lithic assemblages previously assigned to the DOA and Classic Oldowan. Significant diachronic variation in raw material availability and use is, however, identified between Bed I and Lower/Middle Bed II of Olduvai Gorge, which may go some way to explaining the originally perceived techno-cultural differences. The results suggest an increase in hominin knapping and percussive activities, as well as a clear ability to preferentially select high quality raw materials stratigraphically above Tuff IF. Technological innovation and complexity, however, does not seem to vary significantly between the Classic Oldowan and DOA assemblages. The results of this analysis along with similar studies from the wider eastern African region lead to the conclusion that the term Developed Oldowan A should no longer be used.

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## 1. Introduction and background

### 1.1. Olduvai Gorge and the Oldowan

Olduvai Gorge is one of the most important Early Stone Age archaeological and paleoanthropological sites in the world. Since its scientific discovery in 1911 (Leakey, 1978), it has been paid constant attention by researchers investigating a wide range of issues, including archaeological studies investigating the nature of early hominin technological evolution (Leakey et al., 1971; Stiles, 1979; Wynn, 1981; Potts, 1988; Kimura, 1999; Ludwig, 1999; de la Torre and Mora, 2005, 2014; Diez-Martin et al., 2010, 2014), subsistence strategies (Speth and Davis, 1976; Bunn, 1981; Blumenschine et al., 2012a, b; Bunn and Gurtov, 2014; Domínguez-Rodrigo et al., 2014; Organista et al., 2016), and paleoanthropological work describing and increasing our current knowledge base of hominin fossils (Leakey and Leakey, 1964; Leakey, 1969, 1971; Holloway, 1980; Kidd et al., 1996; Clarke, 2012; Njau and Blumenschine, 2012; Ungar

et al., 2012; Hlusko et al., 2015), as well as geological research concerned with correlating and refining the dating of archaeological and hominin remains (Hay, 1967, 1976; Walter et al., 1991, 1992; Deino, 2012; McHenry, 2012; Stanistreet, 2012).

In Mary Leakey's 1971 monograph on the archaeology of Beds I and II, she described in full the Oldowan technology identified at Olduvai and put forward a classification system, defining the Oldowan in terms of typological tool forms (Leakey, 1971). These were represented by various forms of choppers (side choppers, end choppers, pointed choppers, two-edge choppers), protobifaces, polyhedrons, discoids, heavy duty scrapers, light duty scrapers, subspheroids, burins, hammerstones, utilized cobbles, and light duty flakes (Leakey, 1971). While Leakey described the Oldowan as unchanging in form and composition throughout Bed I, she recognized two variations of this technology in Lower and Middle Bed II based on relative frequencies of typologies. The first was a slightly more advanced version of the Classic Oldowan, differing only in the increased frequency of proto-bifaces, spheroids and subspheroids, and light duty tools, coupled with a decrease in choppers (Leakey, 1971). The term Developed Oldowan A (DOA) was used to describe this technology and was identified initially at

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two archaeological sites: HWK E Levels 3, 4, and 5 and FLK N Sandy Conglomerate. The lithic material at HWK E Level 2 was initially considered to be an intermediate form between the Oldowan and DOA (Leakey, 1971), but it was later included within the DOA (Leakey, 1975). The number of DOA assemblages increased through the excavation of MNK Chert Factory Site (Stiles et al., 1974) after the publications of Leakey's monograph (Leakey, 1971). The lithic material from this assemblage was predominantly produced on chert and, as such, did not show the full typological core forms originally identified by Leakey; however, its stratigraphic location within the sandy conglomerate unit of Bed II made it contemporaneous with the upper level of HWK E and FLK N Sandy Conglomerate (Stiles et al., 1974).

The second variation within the Oldowan, which Leakey identified as the Developed Oldowan B (DOB), was considered as a continuation of the DOA (Leakey, 1975). It was initially differentiated in typological terms through an increased frequency of light duty tools including scrapers, burins, awls, outils écaillés, and laterally trimmed flakes (Leakey, 1971), as well as the inclusion of crude, diminutive handaxes. All archaeological sites assigned to the DOB were identified above Tuff IIB and comprised MNK Main Site, FC West, SHK, BK, and the Upper and Lower floors of TK (Leakey, 1971). Initially, Leakey (1971) identified the major distinction between the DOB and the DOA as the presence of bifaces within DOB assemblages, with no such artifacts identified in DOA assemblages (Leakey, 1971). Leakey distinguished the Acheulean from the DOB as sites that contained greater than 40% bifaces (Leakey, 1971). She later expanded on this distinction, noting that the handaxes within SHK, BK, and the Upper Floor of TK could be considered less skilfully produced than those found at MNK and the Lower Floor of TK, which were relatively comparable to those identified within Acheulean assemblages (Leakey, 1975).

Traditionally, the Oldowan and Acheulean followed a dual phyla model, the former being associated with *Homo habilis* and the latter associated with *Homo erectus* (Leakey, 1971). This led to the suggestion that the DOA and DOB may also be distinguished from the Acheulean in terms of paleoanthropological association (Leakey, 1975). It was suggested that both the DOA and DOB were produced by *H. habilis* with the latter taken as evidence of inter-species technological mimicry or appropriation (Leakey, 1971, 1975). This was a marked departure from Louis Leakey's previous view of cultural evolution at Olduvai, which was argued to be a gradual evolution from simple Chellean material to more advanced Acheulean handaxes, produced by a single hominin species (Leakey et al., 1931; Leakey, 1951, 1954).

### 1.2. The Developed Oldowan

Mary Leakey's (1971, 1975) definition of the Developed Oldowan has provoked much debate on the validity of this categorization, the greater part of which has centered on the distinction between the DOB and the Acheulean, as it is this transitional period that saw the advent of a new technology and new hominin species (de la Torre and Mora, 2014). Advocates for the distinction between the DOB and Acheulean have used typological statistical analyses of Leakey's original data (Davies, 1980; Callow, 1994; Roe, 1994) and first-hand re-analyses of specific tool types (Bower, 1977) to justify the distinction. Those advocating the removal of the term DOB, and its inclusion within the Acheulean, argued for functional differences caused by variation in local environmental contexts (Isaac, 1969, 1971; Hay, 1976; Gowlett, 1988) or raw material variability (Stiles, 1977, 1979; Voorrips and Stiles, 1980), as opposed to technological or cultural factors. Recently a small number of first-hand re-analyses of the Olduvai assemblages (de la Torre and Mora, 2005, 2014) and comparisons of the Olduvai assemblages to a wider

archaeological sample throughout East Africa (Semaw et al., 2009) have renewed calls for the removal of the DOB as a distinctive cultural entity, arguing that these assemblages should be included within the Acheulean. The primary justification for this inclusion of the DOB into the Acheulean depends upon the fact that DOB assemblages contain technological elements also commonly associated with Acheulean, including the ability to produce large flakes, the production of true bifaces, management of small core debitage, and the production of retouched material (de la Torre and Mora, 2005, 2014; Semaw et al., 2009).

The distinction between the 'Classic Oldowan' and DOA, however, has raised little concern over the years, with a wide acceptance of Leakey's (1975) general view of it as a slightly advanced form of the Oldowan (Bower, 1977), with advocates relying on the continued use of Leakey's typological perspective. These studies included statistical analysis of production technique variation of a single or restricted number of tool types at Olduvai (Bower, 1977). Wider-scale investigations into typological variation (Stiles, 1981; Gowlett, 1988) either dismissed the DOA as "simply a somewhat evolved form of Oldowan, in which bifacial working is increased, but in which there are no radical new departures" (Gowlett, 1988: 14), or grouped it together with the DOB, referring to it as the Developed Oldowan, with no apparent justification (Kurashina, 1987). Early technological approaches to the study of the Oldowan and DOA also maintained Leakey's initial distinction between the two (Kimura, 1997, 1999, 2002; Ludwig, 1999).

In a substantial comparative analysis of Oldowan, DOA, DOB, and Early Acheulean assemblages across eastern Olduvai (Ludwig, 1999) argued that an increase in chert cores, quartzite spheroids, and subspheroids represented a departure from the Oldowan in terms of an increased understanding of fracture mechanics. However, it was argued that, when compared to the wider Oldowan lithic assemblages, no differences in the reduction of chert cores were apparent. Furthermore, it was suggested that an increase in the utilization of quartzite during the DOA was potentially linked to increased technical understanding and ranging patterns (Ludwig, 1999). The higher frequency of quartzite spheroids and subspheroids was explained because of advances in hominin understanding of advantageous raw material properties, evidenced further by the ubiquitous use of chert during this period for the production of flakes. Having noted these variations, however, Ludwig (1999) maintained the Oldowan/DOA distinction, arguing its validity, not based on typological tool type frequencies, but on variation in hominin cognitive ability.

Kimura (1997, 1999, 2002), on the other hand, although maintaining Leakey's nomenclature throughout, identified a wide range of technological similarities between the Classic Oldowan and DOA assemblages at Olduvai Gorge. These included static trends in local raw material selection, preferential selection of raw materials for flake production, the frequency of bifacial reduction, and the length of bifacial edges of cores, reduction intensity, and continuity of percussive tool use. It was also argued that knapping skill levels remained consistent throughout the Oldowan and DOA, citing similar levels of hinge fractures during the Oldowan and DOA, and arguing that an apparent increase in knapping accidents during the DOA was largely a factor of the exploitation of irregular chert nodules, being no reflection on the degree of knapping skill employed. It was argued that the appearance of chert during Lower-Middle Bed II was the driving factor behind the identification of the DOA, with little actual technological difference present (Kimura, 2002). Having said this, however, Kimura (2002) still endorsed the DOA as a valid distinction between the Oldowan and at no point suggested its removal from the vernacular.

More recently, a full technological re-analysis of Bed I and II assemblages by de la Torre and Mora (2005) argued for the

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