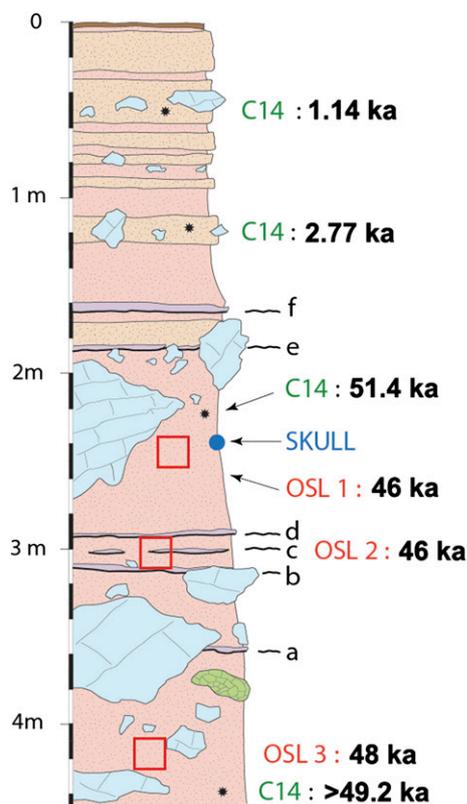


## Reply to Pierret et al.: Stratigraphic and dating consistency reinforces the status of Tam Pa Ling fossil

We recently presented a human fossil from Tam Pa Ling (TPL), Laos (i.e., TPL1), that is the earliest definitively modern human fossil in eastern Asia (1). Unfounded criticism of this research, showing partial readings of this publication, has been raised by Pierret et al. (2). They allege that (i) the chronology is not stratigraphically consistent, (ii) TPL1 was an intrusive burial, and (iii) other human fossils in Asia are older.

They question the validity of the dating because of an apparent “reverse stratigraphy” (Fig. 1), whereby “older” dates are located higher in the section [i.e., 51.4 ( $^{14}\text{C}$ ) at 2.1 m] and “younger” dates are at the bottom of the section [i.e., 48 ka (optically stimulated luminescence [OSL]) and >49.2 ka ( $^{14}\text{C}$ ) at 4.3 m] (2). This criticism ignores the presented SEs (table 2 and table S1 in ref. 1), which make the results statistically equivalent (Table 1). More importantly, they ignore that the radiocarbon results are well beyond the accepted radiocarbon barrier of  $\sim 40$  ka (3), indicating that the charcoal has a minimum age of  $\sim 40$  ka. Bearing in mind these problems, we have conservatively estimated the burial age to be  $\sim 46$  ka according to the luminescence dating of the sediments. As the



**Fig. 1.** The 4-m stratigraphic section from TPL. Provenience of the charcoals sampled for  $^{14}\text{C}$  dating and soil sampled for OSL dating are identified on stratigraphy. TPL1 was found at a depth of 2.35 m.

**Table 1.** Age estimates and SEs for TPL radiocarbon, OSL, and U-series samples

Sample	Dating method	Depth, m	Age, y	SE, y	Cl, y
TPL b	$^{14}\text{C}$	2.1	51,400	$\pm 3,300$	48,100–54,700
TPL1	OSL	2.35–2.55	46,000	$\pm 4,000$	42,000–50,000
TPL2	OSL	3.15–3.35	46,000	$\pm 5,000$	41,000–51,000
TPL 09–3	$^{14}\text{C}$	4.3	>49,200	—	>49,200
TPL 3	OSL	4.2–4.4	48,000	$\pm 5,000$	43,000–53,000
TPL1 (L29)	U/Th	2.35	63,600	$\pm 6,000$	57,600–69,600

luminescence results are stratigraphically consistent, we perceive no irreconcilable differences between the stratigraphy and dating.

A second issue they raise (2) is that TPL1 is an intrusive burial, as it is older (63.6 ka U/Th on bone) than the surrounding sediments (Fig. 1). The fossil should, however, be of greater antiquity given that this is not an in situ burial site. Instead, there is an unknown period during which the fossil was outside before being washed into the cave; thus, the age of the sediment burial is younger than the age of the associated fossil remains. Furthermore, the U/Th dating of bone represents a maximum age as a result of an unknown model of Uranium uptake.

Finally, we interpret TPL1 as the earliest human fossil that is both well-dated and fully modern in morphology. Zhirendong demonstrates a mixture of archaic and modern traits, making it significant but not fully modern in appearance (4). Similarly, the metatarsal from Callao Cave is only diagnostic to the genus *Homo* given that it falls within “the morphological and size ranges of *Homo habilis* and *H. floresiensis*” (ref. 5, p. 123). Although the modernity of the Liujiang fossil is not questioned, it has no direct date and no secure stratigraphic provenance. It has been variably dated to *ca.* 20 ka, *ca.* 67 ka, 111 to 139 ka, and >153 ka (6), and this uncertain stratigraphic context has prevented many scholars from accepting any of the dates currently attributed to it (6). We agree on the importance of multidisciplinary work to continue the growing body of research on the Asian fossil record. Well-documented and well-dated fossils like TPL1 with a solid stratigraphic context are integral to this process.

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