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Geoarchaeological Assessment of the Suggested Middle Holocene Age for Monte Verde II, Chile

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Geoarchaeological Assessment of the Suggested Middle Holocene Age for Monte Verde II, Chile

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Geological evidence presented by Surovell et al. (*1*) suggests that the occupation at Monte Verde II (MV-II) dates to the middle Holocene and not the late Pleistocene. The primary geological arguments are: 1) that Chinchihuapi Creek downcut after ~11 ka and that the surface on which the archaeological horizon at MV-II is located did not exist until the Holocene; 2) following channel incision, wood and vertebrate fossils found in SU1 beneath T4 were redeposited onto a Holocene-age surface and mixed with Holocene-age artifacts to produce the archaeological horizon at MV-II. Here we examine these two arguments and discuss other issues with the study.

Argument 1. This argument is based on the assertion that the ~11 ka Lepué Tephra only occurs on T4 and a depositional scenario suggesting that Chinchihuapi Creek was created as a result of post-11 ka downcutting. Neither premise is supported by the data presented in (*1*).

A critical point of their argument is that the Lepué Tephra was deposited on and adjacent to a low swale, with stream channel incision occurring after ~11 ka. According to (*1*, fig. 3), remnants of the Lepué Tephra are preserved on the top of T4, and all later terraces (T3 and T2) were created after ~11 ka. However, the Lepué Tephra also occurs in the upper deposits of T3 (*1*, section 7a, fig. S11; section 8, fig. S13). For the Lepué Tephra to be present at the top of the T3 fill, T3 had to exist before ~11 ka and the incision of Chinchihuapi Creek shown in figure 3 (*1*) must have taken place before ~11 ka.

Additional evidence supporting pre-11 ka downcutting of Chinchihuapi Creek comes from the upper portion of T3. Wood near the top of the T3 fill immediately below the Lepué Tephra (*1*, section 8 fig. S13) produced radiocarbon ages of ~16.1-16.6 ka. While the authors assign these dates to SU1a, the description of the sediments at section 8 do not preclude that they came from the younger depositional fill associated with the formation of T3.

Finaly, two OSL ages, which the authors (*1*) state are accurate and represent depositional ages, were obtained on fluvial sands at the base of T2; ~18.1 ± 1.4 ka (VLL-0674-L; section 4, fig. S8) and ~14.3 ± 1.2 ka (VLL-0676-L; section 9, fig. S14). These sands are 2.5-3 m below the top of the outwash sediments of SU1a on T4. These ages show that the channel of Chinchihuapi Creek had incised to near its present position and was depositing sand by ~18 ka with fluvial deposition continuing until at least ~14.3 ka.

Surovell et al. (*1*) state that the alluvial surface on which the MV-II component rests (Unit MV-7, *2*) did not exist in the late Pleistocene and is instead a product of their early Holocene erosion event. But the two OSL ages show that alluvial deposition occurred from ~18 to ~14.3 ka and thus the alluvial surface was present in the late Pleistocene.

Argument 2. Surovell et al. (*1*) proposed that following incision of Chinchihuapi Creek, wood from SU1b in T4 was redeposited onto the alluvial surface on which the archaeological horizon at MV-II is situated because the wood at MV-II is the same age as wood found in SU1b in T4. They suggest that the MV-II surface represents a mixed context with reworked older wood and Holocene age artifacts. There is no evidence provided to show that wood moved downward from T4 onto the site of MV-II. According to the regional geological and paleoenvironmental records (3-5), a Patagonian Forest formed ~15.1-15.7 ka and was fully developed by ~14.1-15 ka. Thus, trees could have been present on all surfaces exposed at this time in Chinchihuapi Creek (T4, T3, and the alluvial surface at MV-II) during the late Pleistocene.

Surovell et al. (*1*) propose, with no evidence, that the vertebrate fossils of megafauna found at MV-II were redeposited on the alluvial surface at the site. At MV-II over 400 vertebrate fossils were found representing at least seven gomphotheres and other animals (*2*). While Surovell et al. (*1*) found wood in the T4 fill, they reported no fossils in SU1. Hence, redeposition of vertebrate fossils is speculation and was not demonstrated.

Other Geological Issues. While numerous sections were examined and correlated, it appears that important geological contacts went unobserved. The study suffers from the problem of homotaxis (similarity of deposits that are not the same age), especially in correlating sand layers from one location to the next. Their description of T3 as both an erosional and depositional terrace is not geologically possible because cut and fill terraces are created by different processes (erosion vs. deposition) which shows that the terrace sequence of Chinchihuapi Creek is more complex than reported. The authors (*1*) describe SU1a-e sediments as conformable, but there are numerous hiatuses in deposition based on a careful examination of the radiocarbon ages from these sediments. The most egregious failure of this study is the presumed correlation of their SU2 sediments beneath T2 with the site stratigraphy for MV-II (*2*). The stratigraphy described in (*1*) does not match the stratigraphy of MV-II. What they recorded appears to be a Holocene inset terrace fill. Finally, there is no Lepué

Tephra physically below MV-II and the correlations fail to show that the tephra is stratigraphically below MV-II. Most devastating is that critical evaluation of the geochemical data presented by Surovell et al. (*1*) suggests that the tephra is not the Lepué Tephra (*6*). Our comments clearly show the inadequacy of the Surovell et al. (*1*) geological study.

Conclusions. The standards of evidence to support or reject the hypothesis of late Pleistocene occupation of the Americas are high. Years of previous research on and around the MV-II component has yielded numerous radiocarbon ages on artifacts and features directly from the MV-II component in support of a late Pleistocene age for the MV-II component (*2, 6*). The late Pleistocene age for the MV-II component cannot be rejected by the evidence presented by Surovell et al. (*1*).

Supplementary Material. T. D. Dillehay *et al.*, Supporting information for response to "A mid-Holocene age for Monte Verde challenges the timeline of human colonization of South America" (2026). https://doi.org/10.6084/m9.figshare.32149903 or Zenodo.org (search Dillehay) or https://doi.org/10.5281/zenodo.20014451.

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Geomorphological and Archaeological Evidence at Monte Verde II, Chile Supports the Claim of Human Occupation 14,500 Years Ago

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Surovell et al. (1) present three primary arguments challenging the age and cultural integrity of the Monte Verde II (MV-II) site in what is now southern Chile, which is dated to approximately 14.5 ka: (i) the presence of an ~11.0 ka Lepué Tephra is stratigraphically beneath the MV-II, implying a mid-Holocene age for the site; (ii) the existence of an erosional unconformity indicating a temporal hiatus; and (iii) that archaeological wood and associated artifacts in the site were redeposited by fluvial processes. As we demonstrate below, each of these claims is categorically false and found to be unsupported. These claims contain misleading information and methodological and interpretive flaws. Interdisciplinary data and interpretation supporting the information below is provided in Supplementary Information at **https://doi.org/**10.6084/m9.figshare.32149903 or **Zenodo.org (search Dillehay) or https://doi.org/**10.5281/zenodo.20014451

Since the mid-1970s a large interdisciplinary team led by Dillehay spent more than a decade meticulously documenting the archaeology and paleoecology of the Chinchihuapi Creek area, identifying pre-Clovis artifacts, features, the remains of extinct Pleistocene fauna, and a variety of floral remains at the MV-II, all dated to ~14.5 ka (2-5). After a few hours of fieldwork with no excavation, in contrast, Surovell's team proposed that the MV-II site dates to the mid-Holocene and was contaminated by wood and other materials redeposited from older contexts upstream. We uphold the original interpretation of MV-II as a late Pleistocene human occupation.

Surovell et al. did not undertake excavations within the original site location; hence they were unable to study its stratigraphy, *in situ* artifact patterning, and associated archaeological features. Instead, their brief investigation is derived from cherry-picked exposures within the drainage, specifically along creek margins exhibiting complex, discontinuous, and heterogeneous stratigraphy generated by variable depositional regimes and post-depositional erosion. Due to the complex nature of alluvial systems, such contexts are not necessarily stratigraphically equivalent to the primary archaeological sequence documented at MV-II. The result of their study was a biased sampling strategy based on limited geochronological data designed to generate a composite chronostratigraphic schema rather than systematic resampling of intact archaeological deposits from MV-II or the natural stratigraphical equivalents. Consequently, their study

does not constitute a direct reassessment of the site's cultural deposits. Rather, it advances an indirect and misunderstood geomorphic and chronostratigraphic perspective. On this basis, the study is more appropriately characterized as an attempt to re-evaluate the regional paleoenvironmental and geomorphic framework, rather than a direct redating and assessment of the site itself. A critical limitation of this perspective is its overreliance on present-day surficial geomorphology as a proxy for past landscape conditions. This reliance, combined with insufficient consideration of the paleo-ecological dynamics and geomorphological processes characteristic of temperate rainforest systems in south-central Chile, introduces interpretive biases and contributes to substantive errors and misrepresentations in reconstructing site formation processes and stratigraphic relationships.

Chronostratigraphy and Lepué Tephra: Research by Dillehay et al. has resulted in a well-established stratigraphy of MV-II, which shows the primary archaeological component embedded within a terrace (T2 in Surovell et al.) of Chinchihuapi Creek (see SI). A peat layer (MV-5), which directly overlies and seals the cultural component, has been securely dated to ~14.5 ka (2-5). Directly beneath the cultural-bearing unit lies a gray, sandy gravelly surface of an ancient creek platform (MV-7). *Based on integrated archaeological, geochemical, cronostratigraphic, and pollen data, there is no ~11 ka Lepué Tephra below the MV-II archaeological site* (see SI).

Based on the similarity of stratigraphy in different and noncontempraneous depositional contexts, Surovell et al. erroneously correlate a distinct peat horizon located within an upper fluvial terrace (designated T4) on the southern margin of the creek – –purported by them to overlie the Lepué Tephra – –with the ~14.5 ka MV-5 peat layer overlying MV-II. Based on this correlation, they thus extrapolate that the Lepué Tephra must underlie the MV-5 peat and MV-II. The peat layer and presumed Lepué Tephra sequence identified by Surovell et al. in the upper stratigraphy of T4 occur several meters higher in elevation and are spatially removed from the MV-5 peat within the site context. These differences in vertical position and lateral separation indicate that the two peat deposits are not correlative but instead represent discrete depositional episodes formed at different times under distinct geomorphic conditions. Moreover, recent analysis of exposed stratigraphic sections sampled by Surovell et al. indicates that two of the three layers they classified as tephra are more accurately interpreted as a fungal deposit and an iron oxide–rich pyroclastic bead layer. The third layer is unlikely to correspond to the Lepué Tephra and instead represents a younger volcanic deposit. Consequently, the proposed stratigraphic correlation is incorrect.

Perhaps most problematic is the fact that Surovell et al. introduce a new stratigraphic schema (SU2) not recognized in the MV-II sequence and artificially superimpose it onto the site's stratigraphy (see Figure 2 in Surovell et al.) without adequate justification. Leaving aside the fact that their figure wrongly implies that their ages were sampled directly above and below the primary cultural-bearing deposit, the associated radiocarbon and optically stimulated luminescence (OSL) dates are internally inconsistent and stratigraphically disordered in the SU2 unit. The uppermost layer (Stratum 6) is dated to 4.2–4.4 and 4.6–4.8 ka. Beneath it, Stratum 7 dates to 7.2–7.3 ka, and Stratum 8 to 4.9–5.3 ka. Immediately below these, and directly overlying the MV-II component, Stratum 9 yields dates of 13.1–13.2 ka. The layer underlying the MV-II component has dates ranging from 11.9–16.7 and 15.3–20.9 ka. This stratigraphic and chronological sequence is internally inconsistent and does not support the presence of an ~11.0 ka tephra underlying MV-II. Instead, the directly underlying and overlying dates of SU2 place MV-II in the late Pleistocene, consistent with the stratigraphic and chronological data from the site indicating an age of ~14.5 ka.

Hiatus ("Missing Time"): While it may be possible that erosional unconformities were identified elsewhere throughout the drainage, this observation has little to no bearing at the site. In fact, there is no stratigraphic evidence within the MV-II deposits that supports the existence of a relevant erosional unconformity or temporal gap within the late Pleistocene cultural sequence. The depositional context remains continuous and intact. While there is an erosional unconformity and a hiatus associated with stratum MV-4 in the site, it occurred later between 8.0 and 9.5 ka and has no bearing on the MV-II site.

Fluvial Redeposition of Wood and Artifacts: Despite providing no geological evidence that would suggest such an event, Surovell et al. propose that natural wood and mid-Holocene archaeological artifacts were transported from the upper T4 terrace deposits and redeposited by flooding in the MV-II site. However, this interpretation is inconsistent with empirical observations and the geology and archaeology of both the site area and the site itself. Woody remains in the upper terrace do not contain logs and tree limbs comparable to those recovered from MV-II (see SI). Extensive excavations in the site area over the past fifty years– –including more than 70 test pits, trenches, and block units in T4 – –have documented only plant remains indicative of a landscape marked by treeless shrubby vegetation within the upper levels (5). During the alleged period of flooding and redeposition, the environment was a sandur plain characterized by a periglacial environment unlike the present-day Nothofagus and Valdivian rainforest. It is highly unlikely that large deposits of wood like those patterned in the archaeological site would have been available for redeposition.

Moreover, systematic archaeological and geological investigations–including stratigraphic survey, controlled excavation, and auger sampling–conducted along the narrow upstream portion of the Chinchihuapi Creek drainage have identified only two archaeological localities. These consist of a ceramic occupation (X-12) and a multicomponent early Holocene and late Pleistocene site (CH-1). Both sites have undergone extensive excavation and exhibit well-preserved *in situ*stratigraphy, with no sedimentological or taphonomic evidence indicative of fluvial erosion, transport, or secondary redeposition. In particular, the integrity of cultural materials and associated depositional contexts demonstrates an absence of hydraulic reworking or downstream displacement. Furthermore, no additional occurrences of redeposited faunal remains, woody debris, or anthropogenic artifacts have been documented in other exposed stratigraphic profiles along the creek. This absence is notable given the substantial extent of observable cutbank exposures–exceeding 1.5 km in cumulative length–within the study area. Long-term field observations spanning approximately five decades by the Monte Verde research team, as well as the brief observations by Surovell et al., similarly report no evidence of comparable secondary deposits. Given these observations, the hypothesis that a discrete flooding event originating from the T4 terrace selectively transported and deposited archaeological materials at a single, localized point within the creek basin is difficult to reconcile with the broader geomorphological and archaeological record. Such a scenario would require a highly anomalous, spatially restricted depositional process that is not supported by local stratigraphic continuity, sediment transport patterns, and the presence of cultural materials only in the MV-II site.

The authors also state that: "…. Pino and Dillehay… present more than 40 new radiocarbon dates on two cores that are approximately 50 m north of MV-II…and correlate the results to the site's cultural and chronological sequence…these cores were taken from T4 and are clearly not from the same context as the site's cultural sequence…. This again confirms the presence of organic matter [implying wood from trees] at the top of T4 available for redeposition…" Surovell et al. misplaced the cores on T4 to support their argument. The cores were taken from the MV-II stratigraphic sequence below in the T2 terrace and not the T4 terrace (see SI). The MV-5 peat represents a localized gallery bog confined to the creek basin (T2 and adjacent creek bed), whereas the peat and tephra deposits in T4 belong to a separate, recent depositional event unrelated to the MV-II site. This misplacement and miscorrelation of the cores by Surovell et al. undermine the proposed redeposition hypothesis and reinforces the integrity of the MV-II stratigraphy and its late Pleistocene age (see SI).

Archaeological Patterning and Site Integrity: The MV-II assemblage exhibits clear spatial patterning within a thin (2–3 cm) cultural layer overlying the ancient T2 terrace surface. Surovell et al.'s study does not account for the patterned spatial distribution of artifacts and features across this layer (6-9). The osteological assemblage includes bone and hide remains, and pieces of meat representing at least seven individuals of *Notiomastodon*, an extinct late Pleistocene proboscidean, and one specimen of *Paleolama,* an extinct late Pleistocene camelid. Most of the bones consist of ribs and rib fragments mainly concentrated within an activity area roughly 3 by 4 m in size. The assemblage also includes numerous modified bones, such as a *Notiomastodon* tusk fashioned into a gouge and ribs probably used as digging and other tools. The absence of abrasion, rounding, water-polish, or other taphonomic indicators of fluvial transport further supports *in situ* deposition. Additional artifacts include a fire-hardened wooden lance, wooden digging sticks, stakes with burned tips, and other wooden implements. These and other artifacts and features (e.g., hearths, small storage pits) were dispersed in and outside of the remains of two hut-like structures. Botanical remains recovered from the site includes potato tubers and stems embedded in the cracks of a wooden grinding slab, several species of marine seaweed and other edible and medicinal plants originating from local and non-local environments. Additional evidence contradicting the Chinchihuapi flood hypothesis includes the preservation of human footprints within the occupation surface, one of which displays clear morphological details adjacent to a hearth. The spatial patterning of these materials indicates intentional human activity and not redeposition by water (6-9). The redeposition hypothesis also introduces chronological inconsistencies, requiring megafaunal exploitation long after their extinction and the reuse of significantly degraded and fractured wood for tools and fuel.

Radiocarbon dates from quids comprised of marine algae (e.g., *Gigartina* sp., *Porphyra* sp., *Mazzaella* sp.) and an exotic terrestrial plant (boldo, *Peumus boldus*) recovered from cultural features yielded calibrated ages between 14.2 and 14.3 ka (9-10). A recent unpublished date on *Porphyra* sp. specimen was assayed at 14.47 ka. These dates are consistent with those obtained from other dated short-lived plant species and assays on megafaunal bone remains, wood artifacts and charcoal from hearths, all ranging between ~14.2 and 14.6 ka in age. It is highly improbable that intact quids of marine algae could withstand fluvial transport and subsequent redeposition from one location to another. Such materials are structurally fragile and highly susceptible to mechanical degradation, disaggregation, and biochemical decay during hydraulic reworking. Consequently, their preservation in an undeformed, cohesive state strongly indicates primary deposition rather than secondary redeposition via fluvial processes. Together, these independent datasets confirm the late Pleistocene age of the MV-II occupation.

Conclusion: While critical reassessment is essential in any research, interpretations must be grounded in direct observation, an extensive geomorphological study, stratigraphic integrity, and internally consistent datasets. The arguments presented by Surovell et al. rely on misrepresentations of and extrapolations from non-site contexts, unsupported stratigraphic correlations, and selective use of data. These misrepresentations and errors invalidate the critiques by Surovell et al. and do not successfully challenge the extensive archaeological and geological evidence supporting MV-II as a well-preserved late Pleistocene occupation dated to approximately 14.5 ka.

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Genetic evidence and the peopling of the Americas: reply to Surovell et al. 2026

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Genetic evidence and the peopling of the Americas: reply to Surovell et al. 2026

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Surovell et al. (*1*) assert that the Monte Verde II site (Chile) is only ~8200 years old, far younger than its previously established age of 14,500 years before present (14.5 ka) (*2–4*). If correct, this would eliminate this as one of the pre-Clovis age sites in the Americas. We might have had confidence in their claim: 1) had their investigation taken place at the site; 2) had the 11.5 ka tephra layer they claim was a local chronological marker bed beneath the 14.5 ka MV-II component been shown to occur at the site, or even in the majority of their cutbank exposures, or been correctly identified; or 3) had they attempted to explain why none of their cutbank sections had evidence – as occurred in the MV-II component – of proboscidean bones, tusk and hide, associated artifacts, multiple hearths, wooden structures, a sand and gravel feature possibly hardened by animal fat and lined with vertical wooden stubs, an unexpectedly diverse set of plant remains, and so on (*2*, *3*). However, they did none of those things.

On that problematic foundation Surovell et al. (*1*) make several questionable claims about the peopling of the Americas and how we understand that process. For one, they state that "the age of the MV-II component should not be used as a constraint or check on colonization models derived from other sources, including the genetics of modern or ancient populations." To suggest it has been so used is incorrect. Genetics-based inferences on the peopling of the Americas derive from an entirely independent empirical foundation, with its own data, assumptions, consistency tests and explicit caveats.

Importantly, their conclusion that "a Holocene age for Monte Verde leaves open the possibility of later initial colonization," fails to consider multiple lines of genetic evidence – uniparental and genomic – from present-day and ancient individuals that independently support a pre-Clovis occupation of the Americas. As early as 1993, and quite separately from Monte Verde, mitochondrial DNA (mtDNA) based estimates placed the initial peopling between 21 ka and 14 ka years ago (*5–7*). In fact, the single early study to reference Monte Verde (*8*) suggested that genetics could serve to check the archaeology, not vice versa.

More recent analyses using single locus markers with much larger datasets further refine this picture. Complete mitochondrial genomes suggest divergence of ancestral Native Americans from other populations in Asia no later than ~24.9 ka years ago, the formation of Native American founder lineages 18.4 ka, then a major population expansion starting no later than ~16 ka (*9*). Y chromosome DNA indicates divergence ~18.9 ka (95% CI: 16.7 ka – 21.4 ka) and expansion ~15 ka (95% CI: 13.2 – 16.9 ka) (*10*).

Likewise, genome data indicates all ancient and present-day Native American individuals sequenced to date trace their genomic ancestry to three deep-splitting lineages. *Ancient Beringians* diverged from other Native Americans ~20.9 ka (95% CI: 18.1 ka – 22 ka), followed by a split between *North Native Americans* (NNA) and *South Native Americans* (SNA) ~15.7 ka (95% CI: 14.6 – 17.5 ka). Importantly, detailed demographic modelling inferred the former split was followed by continuous gene flow, while the latter was not (*11*). These results indicate *Ancient Beringians* and Native American ancestors were already isolated from each other when NNA and SNA populations split ~15.7 ka.

The Laurentide and Cordilleran ice sheets were a likely isolating mechanism, which at the time complicated continued migration between eastern Beringia (Alaska and the Yukon) and the rest of the Americas (see below) thus supporting a human presence in mid-latitude North America at least 14.6 ka. In agreement with these inferences, no ancient or present-day SNA individuals have been identified north of the continental ice sheets in either eastern Beringia or Siberia. Conversely, individuals from North America and South America associated with disparate material cultures, e.g., Clovis and Western Stemmed Point Tradition, or supposed anatomically-distinct groups ('Paleoamericans') previously attributed to separate migrations, are nonetheless part of the same SNA lineage (*12–15*).

The location where the ancestors of Native Americans isolated from other Eurasians also has an important bearing on these inferences, as it constrains the location of the NNA/SNA split ~15.7 ka (*11*, *16*). Genomic evidence shows that Native Americans originated from an admixture event between East Asian and Ancient North Eurasian-related groups ~25-20 ka (*11*, *17*, *18*). The admixture between both groups most likely occurred in Siberia and continued after the Last Glacial Maximum (*17*, *19–22*). However, all known ancient and present-day individuals from northern East Asia (*23*, *24*), southern and northern Siberia (*18–22*) and even western Beringia (*17*), carry mostly East Asian or Ancient North Eurasian-related ancestry, or a mixture of both (*Ancient Paleosiberians*) but in significantly different proportions than Native Americans. To date, we see no evidence of ancestral Native Americans in those regions.

Direct genetic evidence also shows a pre-Clovis human presence south of the continental ice sheets. There is ancient mtDNA evidence of Native American lineages from human coprolites from Paisley Caves (Oregon) (*25*), dated to ~14.6 ka (*26*, *27*). Additionally, pre-Columbian dogs, which presumably would not have come to the Americas without people, descend from a lineage that split from all other dogs and expanded ~14.6 ka (95% HPD: 13.74 ka – 17.65 ka) (*28*, *29*).

All Native American descendant lineages are found exclusively in the Americas or among populations with Native American ancestry. This pattern is difficult to reconcile with scenarios in which the expansion occurred outside the Americas. Further, mtDNA-based estimates of a ~60-fold effective population size increase between 16 ka to 13 ka (*9*) is strong evidence of the expected large-scale demographic expansion that would follow entry into a previously unoccupied continent, and by several independent molecular clocks that expansion took place in pre-Clovis times.

Surovell et al. (*1*) state that the acceptance of a pre-Clovis age for Monte Verde led some to reject the interior ice-free corridor as a possible route of initial entry into the Americas south of the Cordilleran and Laurentide ice sheets, as these would not have receded enough by 14.5 ka to allow travel south from Beringia. At that time only the Pacific coast was sufficiently deglaciated to allow movement south.

They in turn claim that if Monte Verde II is no more than 8200 years old, then its revised age supports "an initial interior migration into continental North America." It is difficult to imagine why that would be the case. Even if Monte Verde were not occupied until the Middle Holocene, that can have no bearing on deglaciation that took place 10,000 km to the north and started as much as 10,000 years earlier. However, direct geological and genetic evidence from the corridor region can.

Based on cosmogenic ^{10}Be exposure ages the Laurentide and Cordilleran ice sheets began to separate at both its northern (Yukon/NWT) and southern (Alberta) ends, much like a winter coat that unzips from the top and bottom. Initial separation started ~17.5 ka, and the 'unzipping' was complete by around 14 ka (*30–32*). Yet, it took time for the recently deglaciated corridor to become an ecologically-viable passageway with resources necessary to support hunter-gatherers making the ~1500 km migration through the corridor.

Evidence for when the corridor became viable comes from independent DNA evidence. During the Last Glacial Maximum bison from north and south of the ice sheets evolved distinct mtDNA lineages that remained separated until ~13 ka (*33*). Similarly, environmental DNA from lake sediment cores in the center of the 'zipper,' the last section to become ice free, shows the arrival of animals (including

bison, mammoth, elk) only in sediments younger than ~12.6 ka (*34*).

In effect, an interior route would not have been available in early Clovis times. This helps explain the relative dearth of Clovis fluted point material in the corridor region, and why the forms that occur appear to be traces of groups who were descendants of population(s) who'd arrived south of the continental ice sheets in pre-Clovis times and were moving north up the newly opened corridor (*35*).

The conclusions drawn by Surovell et al. (*1*) disregard not only the Monte Verde II evidence, but also decades of research in diverse disciplines. Their lack of engagement with the full range of site data, selective use of the broader literature and overstated conclusions do not advance scientific discussion nor the field of first Americans studies.

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