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E-letter concerning the consistency of the cultural sequence in "Supplementary Materials for Two Thousand Years of Garden Urbanism in the Upper Amazon" (1).

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The article "Two thousand years of garden urbanism in the Upper Amazon" (*2*) sparked our interest, and after a close examination we have serious concerns about inconsistencies between the text narrative and the supplementary data offered to support the claims. We found serious flaws in the data, as well as in how the data is analyzed in the article.

An important part of the article is the analysis of the chronological sequence of the observed archaeological features. But this analysis includes several inconsistencies, probably invalidating many of the results presented in the article.

According to the authors, ”two sites yielded two complex and comparable stratigraphies (Fig. S11).” (*1*). But in fact, only one stratigraphy is shown in Fig. S7. Moreover, section S2 (Datings) mentions a list of almost 70 radiocarbon dates, which are neither provided in this text nor in the earlier work cited (*3*). Due to these omissions, it is not possible to verify the chronological reconstruction presented in the Science article. Their chronological sequence representing five stages presents also inconsistencies:

1.- The first occupation, named the Sangay culture (700 to 500 BCE), supposedly left few remains (*4, 3, 1*); but the ceramic analysis of the "*Lomita*" refuse pit in Sangay complex, provides abundant details on their presence (*5, 6*). Named earlier as Upano I by Porras (*7*), at "*Lomita*", the Sangay assemblage is associated with deeper and mid- levels (200-206 to 170 below datum) dating between 165 BCE-CE 160 (Beta - 100307) and CE 425-655 (Beta - 100306), respectively (*5*: Graphics 12, 13 and Table 1, *6*: Table 1), disappearing at upper shallow levels.
The temporal disparity between the findings from "*Lomita*" refuse pit (*5*; *6*) and the dates suggested by Rostain et al. (*1*) requires further enquiry. In the refuse pit "*Lomita*" it is clear the coexistence of the "Sangay culture" with other "archaeological cultures" (Upano and Huapula: CE 780-1175, Beta – 100305 (*5, 6*)). Therefore, this implies a site with several pottery types that are all part of the same archaeological culture of long spatial-temporal occupation in the complex Sangay. In fact, the probabilistic sum of the calibrated dates of "*Lomita*" with ShCal2020 (*8, 9*), suggests chronological coherence and interception, when assuming 2 and 3 sigma (fig. 1). In addition, the fill pattern of the refuse pit was continuous and without any cultural or natural hiatus (*10*).
Fig.1_SHCal20 dendrocurve displaying the 14C dates of La Lomita (including 68.2%, 95.4% and 99.7% sigma).png
2.- For dating the second occupation (named Kilamope culture), the authors take the date (500 BCE) as the beginning of mound construction, based solely on a single radiocarbon date (Lyon 4247= 2965 BP) which is not valid for dating neither an event nor a phase (*11*). The sample, taken from the base layer from the southern mound of the complex (*3*), lacks information on its standard deviation and on the C13 isotope values, crucial for assessing the stability and precision of the sample. As a result, the information used for dating this initial phase of platform construction in the region is very weak.
3.- The Upano as a mound builder culture, and its age is probably from ~500 BCE, consistent with the radiocarbon dating of the region. However, the reasons for its apparent disappearance around 300/600 CE are poorly demonstrated. The presence of a layer of volcanic ash, shown in Fig. S7 and labelled "black layer volcanic ashes (?)" (*1*), is not verified by a petrographic study. The authors question the hypothesis of a catastrophic eruption of Sangay volcano between 300 to 600 CE "by the disparity of radiocarbon dates recently obtained for these levels" (*2*). Hence, the question to be raised is when this volcanic event took place, instead of even when it happened. To resolve the latter, it is necessary to carefully examine the petrography of the soil content and determine whether there is the presence of volcanic ash layers, and if these could be evidence of a catastrophic event in the region. On the contrary, other authors (*10*, *12, 13, 14*), provide evidence that volcanic ash fall in the region has been slight from at least 2280 BCE to the present day, and that there is no stratigraphic record of a volcanic ash layer, neither in the natural strata, nor in the platforms.
4.- Rostain et al. (*1*) claim that the human occupation that would have succeeded the extinct Upano culture is the Huapula culture (800 – 1200 CE). The question

to be asked is: was there indeed an extinction of the Upano culture with a subsequent replacement by the Huapula culture?
According to the above (see first occupation "Sangay culture") there is interception and chronological continuity between the early dates with the middle ones, and then with the late dates (s. Fig. 1). Furthermore, the information provided by Pazmiño (*5, 6*) shows that there is a coherent and successive transitional ceramic production between the "Sangay", "Upano" and "Huapula" types. These ceramic types were produced and buried continuously in the "*Lomita*" refuse pit, without any natural or cultural gaps (*10*).
As we suggest, a possible explanation for understanding the change of pottery typologies within the second half of the first millennium CE are climate instability lapses (temperate and dry environmental conditions, according to pollen data), that occurred in the region between the ninth and tenth centuries CE. Quite short constant climate changes could have led to the potential abandonment of platforms (*14*). The occurrence of a later LIA composed of a humid and dry successive period is a virtual referent event of such climate variability found in 10 km proxy data from Lakes Cormoran and Chimerella (*15*).
“5. Shuar Culture: They follow the Huapula of whom they are the direct heirs.” (*1*)
Ethnohistorical analyses suggest that during the 16th century, the high Andean *Kañary* societies from the Quizne region (modern-day Riobamba and Cañar highlands) were present in the upper Upano area as small, scattered groups (*16*). This presence occurred one to two centuries after the region's platform complexes were abandoned (*17*). In contrast, Shuar societies (linguistic family “aénts chicham”) were not found in the upper Upano during the 16th century. At the time of initial Spanish contact in 1540, the Shuar were located further south, near the confluence of the Paute and Upano rivers. They made occasional raids on Spanish settlements over the next century but did not occupy the upper Upano until the 18th century (*18*), often aided by missionaries' incursions into Palora, Tigre, and Mayuma headwaters towards the Pastaza River (*19*). Given these historical considerations, the Shuar societies cannot have Huapula culture as their direct ancestors.
Finally, we thank Science magazine for its openness and understanding, as well as respect for its readers in presenting this necessary clarification letter.

Bibliography:

1. Rostain, A. Dorison, G. de Saulieu, H. Prümers, J.-L. Le Pennec, F. Mejía Mejía, A. M. Freire, J.R. Pagán-Jiménez, P. Descola, Supplementary Materials for Two thousand years of garden urbanism in the Upper Amazon. *Science* **383,** 1-20 (2024a). doi:10.1126/science.adi6317
2. Rostain, A. Dorison, G. de Saulieu, H. Prümers, J.-L. Le Pennec, F. Mejía Mejía, A. M. Freire, J.R. Pagán-Jiménez, P. Descola, Two thousand years

of garden urbanism in the Upper Amazon. *Science* **383**, 183-189 (2024b). doi:10.1126/science.adi6317
3. Rostain, Tolas, terrazas y casas: Arqueología del valle del Upano. *STRATA 1* **e2**, 1-20 (2023). https://doi.org/10.5281/zenodo.7547971
4. Rostain, Les tertres artificiels du piémont am azonien des Andes, Équateur. *Les Nouvelles de l'archéologie* **111-112**, 83-88 (2008). https://doi.org/10.4000/nda.380
5. Pazmiño, Análisis cerámico del sitio La Lomita, Morona Santiago, Ecuador, thesis, Pontificia Universidad Católica del Ecuador (2008).
6. Pazmiño, Desarrollo cultural prehispánico en el valle del Alto Upano Análisis cerámico del sitio La Lomita, Morona Santiago, Ecuador. *Antropología: Cuadernos de Investigación* **8**, 149-165 (2009). https://doi.org/10.26807/ant.v0i8.131
7. Porras, *Investigaciones arqueológicas a las faldas del Sangay. Tradición Upano*. (Centro de Investigaciones Arqueológicas. Pontificia Universidad Católica del Ecuador. Quito, 1987).
8. J. Reimer, Evolution of radiocarbon calibration. *Radiocarbon* **64(3)**, 523–539. Advance online publication (2021). doi:10.1017/RDC.2021.62
9. G. Hogg, T. J. Heaton, Q. Hua, J.G. Palmer, C. SM Turney, J. Southon, A. Bayliss, P. G. Blackwell, G. Boswijk and C. B. Ramsey, SHCal20 Southern Hemisphere Calibration, 0 55,000 Years cal BP. *Radiocarbon* **62 (4)**, 759-778 (2020). https://doi.org/10.1017/RDC.2020.59
10. Yépez, "Conviviendo con volcanes catastróficos al este de los Andes ecuatoriales" in *Wege im Garten der ethnologie: Zwischen dort und hier. Festschrift für María Susana Cipolletti*, H. Heinrich, H. Grauer, Eds. (vol 46 of Collectanea Instituti Anthropos, Academia Verlag, 2013a), pp. 383-401.
11. J. Aitken*, Science-based Dating in Archaeology* (Longman Group, 1990).
12. Yépez, "Excavaciones arqueológicas en el sitio Jurumbaino (Morona Santiago)", field report, INPC-R6, Cuenca (2013b).
13. Yépez, E. León, "Bajo las cenizas del Volcán Sangay ocupaciones prehispánicas humanas: Ocupaciones prehispánicas milenarias en las cuencas de los ríos Upano, Palora y Tuna" in *Volcanes y Adoratorios. Historia geológica y mitos de la "Avenida de los Volcanes"*,P. Herrera, Ed. (Casa de la Cultura Ecuatoriana. Quito, 2015), pp. 43-60.
14. Yépez, E. León, "Sobre las nieblas de los volcanes Chimborazo y Sangay: Asentamientos humanos milenarios y paleoambiente" in *Volcanes, cenizas y ocupaciones antiguas en perspectiva geoarqueológica en América Latina*, M. F. Ugalde, Ed. (vol 2 of Estudios de Antropología y Arqueología, Centro de Publicaciones de la Pontificia Universidad Católica del Ecuador, 2017a), pp. 146- 152.

15. Huisman, M. Bush, C. N. H. McMichael. Four centuries of vegetation change in the mid-elevation Andean forests of Ecuador. *Vegetation History and Archaeobotany* **28**, 679–689 (2019).
16. Renard Casevitz, T. Saignes, A Taylor, *Al este de los Andes. Relaciones entre las sociedades amazónicas y andinas entre los siglos XV y XVII* (Abya-Yala. Quito, 1988).
17. Yépez, E. León, "Serpientes y plumas ecuatoriano-peruanas: una perspectiva desde el medio ambiente (ca. 100 a.C.-1000 d.C.)" in *El concepto de lo sagrado en el mundo Andino Antiguo: espacios y elementos pan-regionales*, A. Yépez, V. Moscovich y C. Astuhuamán, Eds. (vol 1 of Estudios de Antropología y Arqueología, Centro de Publicaciones de la Pontifica Universidad Católica del Ecuador, 2017b), pp. 12-42.
18. Taylor, "Estudio introductorio" in *Conquista de la región Jívaro (1550-1650). Relación documental*, A. Taylor, y C. Landázuri N., Eds. (Marka, Abya- Yala, 1994), pp. 1-58.
19. Sarmiento, *La heroína de Motolo: vida y costumbres de los jíbaros. Comité Nacional Orientalista Ecuador Amazónico* (Imprenta Servicios de Suministros, Quito, [1961] 2008, digitized by Indiana University).