Supplement 3 to

Geoarchaeological Investigation in a Domestic Iron Age Quarter, Tel Megiddo, Israel

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Detailed Phytoliths Results

The data presented below correlates phytolith data with sedimentary microfacies. The figures referenced are included herein, rather than in the main article mentioned above. The tables referenced can be found in the main article.

Phytolith Concentrations

Figure 1 presents the concentrations of phytoliths in all samples studied here, according to microfacies. Microfacies A2, C1/C2, C3, D1/D2, and D2 generally have the lowest concentration ranges (mostly between 10 to 20 million phytoliths in 1 g of sediment, and lower). Based on the micromorphological observations, these microfacies relate to construction materials, and the phytolith concentrations reflect the addition of grass material as temper.

Microfacies that have been identified as related to floor construction using large amounts of vegetal matter have, in general, phytolith concentrations above 20 million in 1 g of sediment. These include the ashy form of Microfacies A2 [A2(a)] as well as the phytolith-rich Microfacies B1/B2 and C4. The wide range of concentrations may result from the difficulties in the field of sampling very thin white- or gray-colored layers without external "contamination" by other types of sediments.

Microfacies C5 has been interpreted as the remains of a collapsed, partially burned roof. Samples associated with this feature show wide variation; yet, the bottom part seems to include lower concentrations of phytoliths than the top part, possibly because the bottom part includes mud mixed with vegetal matter (interpreted as a wattle-and-daub frame).

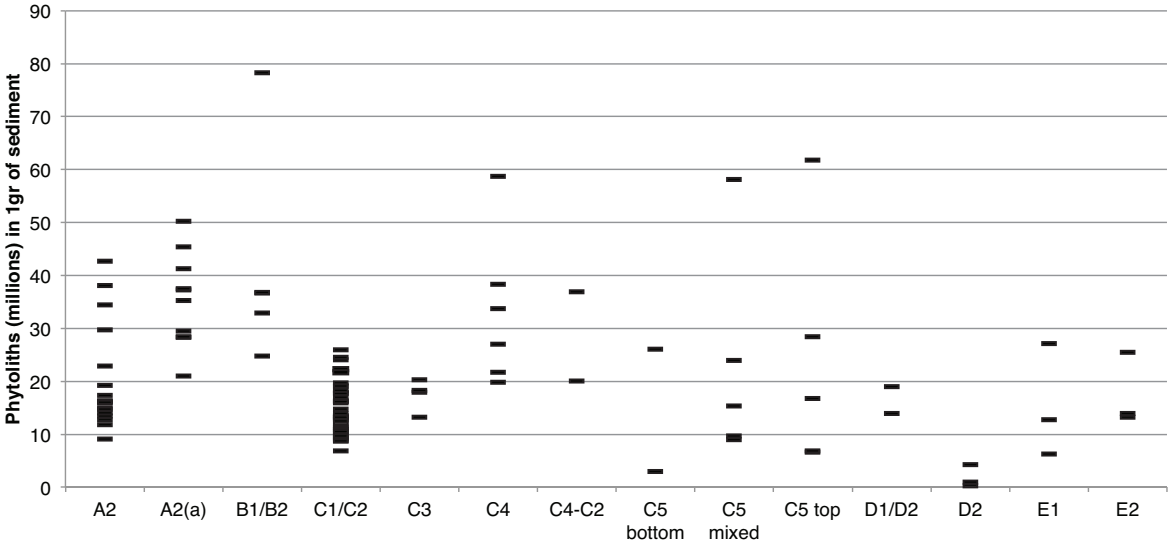

Fig. 1. Phytolith concentrations (millions in 1 g of sediment).

Phytoliths in Anatomical Connection (Multicellular Structures, Silica Skeletons)

Figure 2 presents the percentage of phytoliths that were found in anatomical connection in all samples studied here and according to microfacies. In microfacies related to construction materials (notably A2, C1/2, and D), the proportion of phytoliths in anatomical connection is ca. 10–40%, while in sediments associated with floor and roof construction (A2[a], C4, and C5) their percentage is generally higher. Microfacies B1/B2 show variation between 25 and 50% of multicellular structures, with a group of values above 40% originating from Square B/6 and another group with values of 20–30% originating from Squares E/5 and F/5. We interpret this to indicate differences in degree of trampling, whereas these phytolith-rich layers in Square B/6 are related to floor construction while in Square E/5 they are associated with dung spherulites, thus not related to floor construction. Microfacies E1 and E/2 originate from burning activities. We note that in Microfacies E/2, the two samples having around 50% of phytoliths in anatomical connection were collected in Square C/5 within an oven. This ash is in situ and thus did not suffer trampling.

Overall, we interpret high percentages of multicellular phytoliths to be related to minimal mixing and/or trampling, while those with proportions lower than 40% indicate either purposeful mixing during construction or relatively heavily trampled areas.

Ratio of Grass Phytoliths Originating from Leaf/Stem versus Inflorescence

Our small database from modern grasses give preliminary indication of the ratio expected to represent a whole plant—that is, between 1.2 and 3.2 (see **Table 1** in the main text). We use these values to indicate that (1) a ratio lower than 1 reflects a tendency toward having more inflorescence over leaf/stem plant organs; (2) a ratio lower than 0.5 reflects selection of inflorescence over leaf/stem plant organs; (3) a ratio above 2.5 reflects a tendency toward having more leaf/stem over inflorescent plant organs; and (4) a ratio above 3 reflects selection of leaf/stem over inflorescent plant organs. Most archaeological assemblages have a ratio that represents utilization of whole plants (**Fig. 3**). **Figure 4** is an enlargement of the ratio range between 0 and 5, showing the range found in seven modern grass species in the shaded area. The microfacies that have a ratio close to 1 (i.e., a tendency toward inflorescence overrepresentation) are A2(a), B1/B2, and C4—all are related to floor construction. The microfacies that has ratios well above 3 (i.e., overrepresentation of leaves and stems), is C5—the roof construction. This observation supports the micromorphological interpretation that this feature is indeed a thatched roof. Note that the ratio in Microfacies C5 top is somewhat misleading because some of the sedge leaf phytoliths are virtually indistinguishable from the grass leaf phytoliths, and therefore the ratio increases artificially.

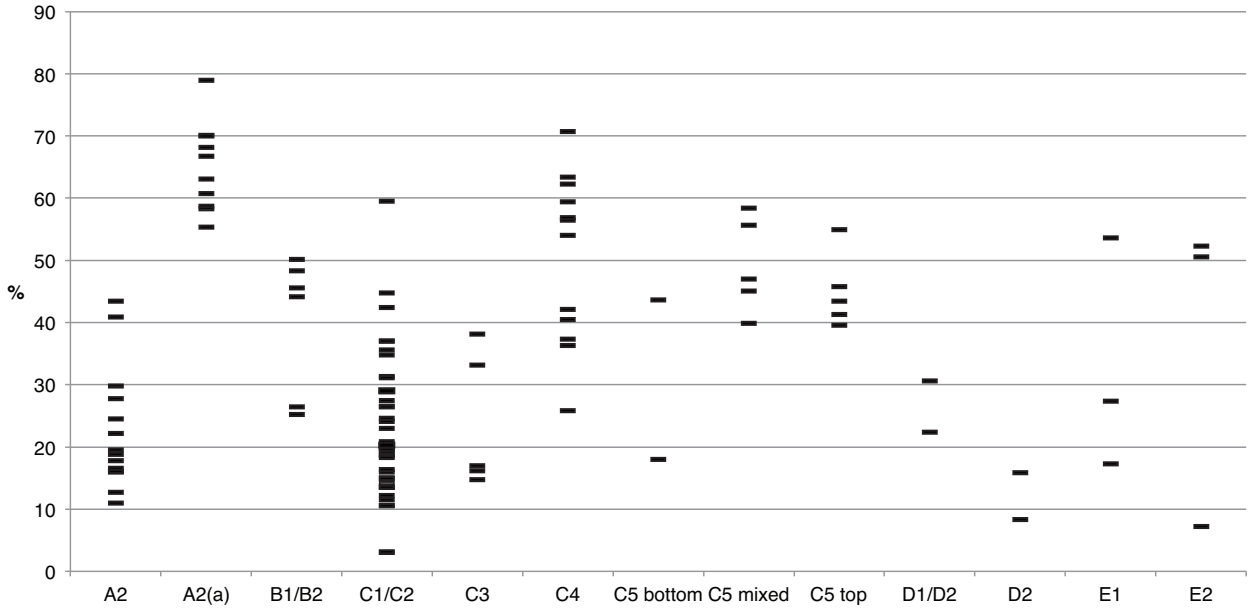

Fig. 2. Percentage of phytoliths found in anatomical connection.

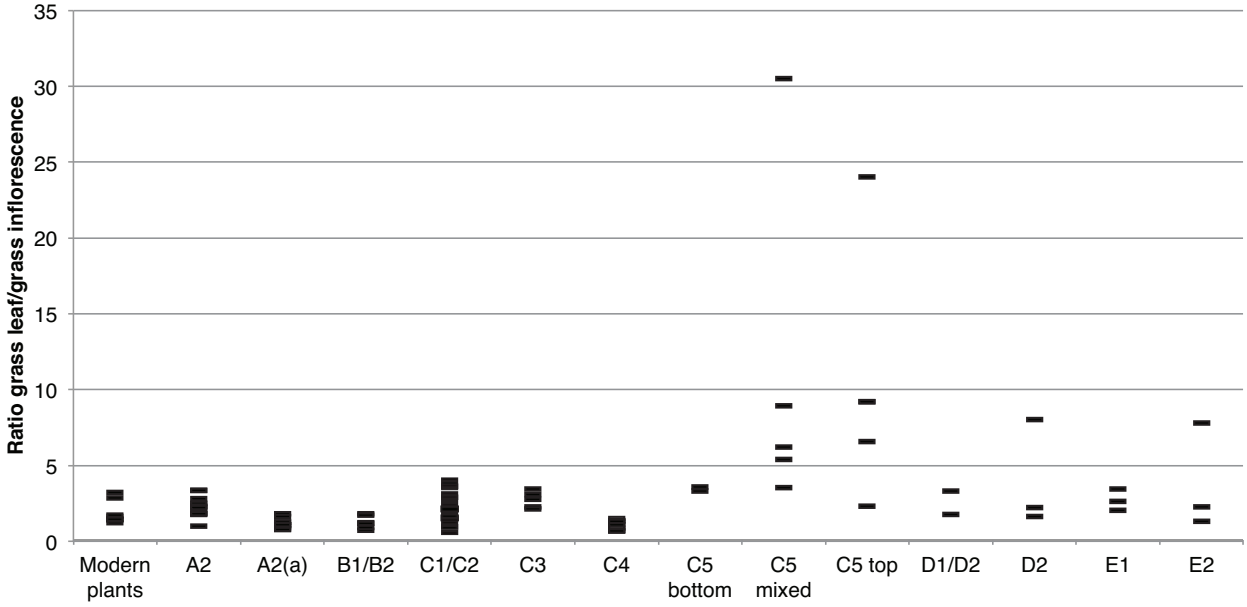

Fig. 3. Ratio of leaf/stem to inflorescence grass phytoliths.

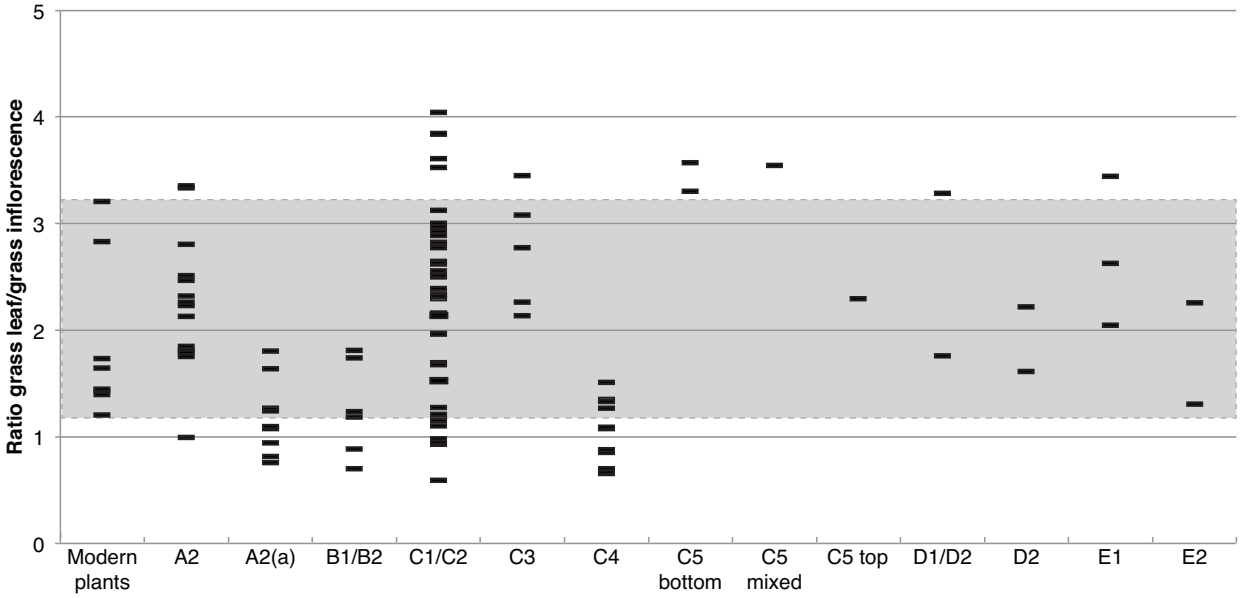

Fig. 4. Detail of Fig. 3 showing the ratio of leaf/stem to inflorescence grass phytoliths, with reference to the modern plant results (shaded area).

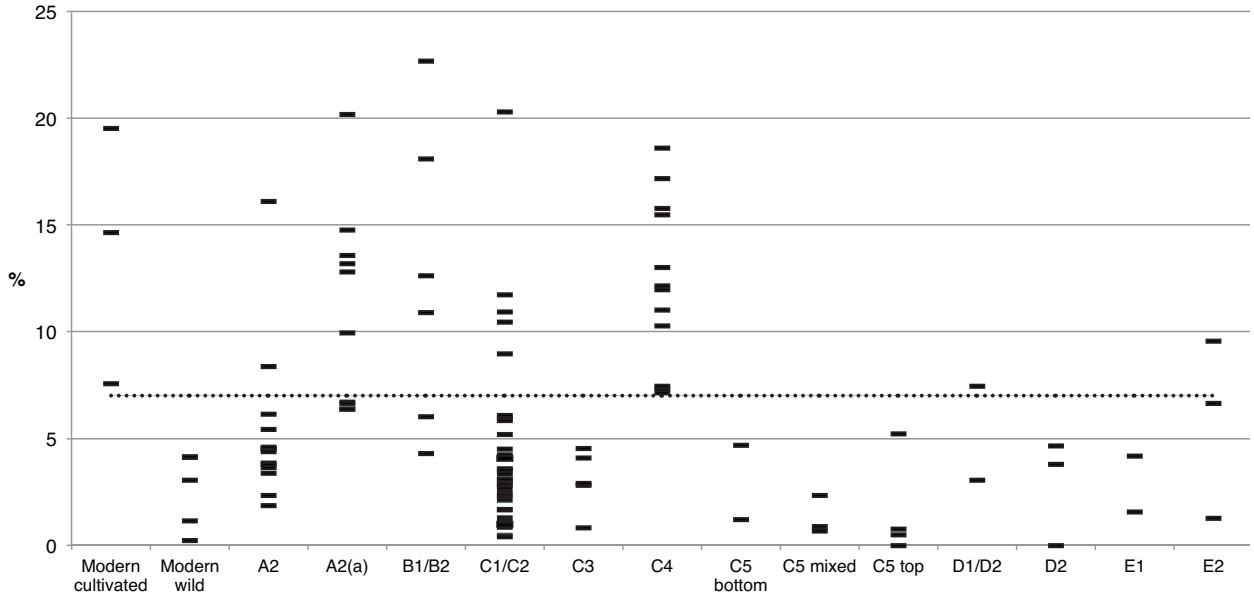

Fig. 5. Percentage of dendritic long cells in the Megiddo Level Q-5 microfacies. The dotted horizontal line indicates the cut-off value in modern plants (from Albert et al. 2008) that separates wild from domestic grasses—that is, samples above the dotted line include domestic grass (cereal) phytoliths.

Percentage of Dendritic Long Cells

From previous studies (notably Albert et al. 2008), it has been shown that the proportion of dendritic long cells in a phytolith assemblage can be used to infer whether a phytolith assemblage originates from wild or domestic grasses. A 7–8% proportion of dendritic phytoliths in an assemblage is taken as evidence for the presence of domestic grasses such as wheat and barley.

The results from Megiddo Level Q-5 assemblages (**Fig. 5**) show that here too Microfacies A2(a), B1/B2, and C4 stand out as those that may be related to domestic cereals. This data is in accordance with the inference noted above, based on the ratio of leaf/stem to inflorescence phytoliths, that these assemblages are dominated by cereal inlorescences (i.e., chaff).

Short Cell Phytoliths

Grasses typical of the Mediterranean zone are dominated by the festucoid sub-family, producing large amounts of rondel-type short cells. Grasses that belong to other sub-families (panicoid and chloridoid) produce short cells in the form of bilobates, polylobates, crosses, and saddles. **Figure 6** presents the ratio between bilobate and saddle short cells to that of rondel short cells; thus, a ratio below 1 indicates dominance of rondel short cells. In the Megiddo Level Q-5 assemblages, the dominant short cell type is rondel. The one exception belongs to Microfacies C5 (roof construction), with high amounts of bilobate short cells. Also taking into account the specific bilobate shape, the most parsimonious interpretation in this context is that these indicate use of reeds (e.g., *Arundo donax*) in the roof construction.

Sedge Phytoliths

Sedge phytoliths, identified based on presence of hat-shaped phytoliths, are scarcely represented in most of the microfacies (no more than 2%) and have not been detected in B1/B2, C3, or D1/D2. They are present in very high amounts in Microfacies C5 top and at slightly lower but significant amounts in Microfacies C5 mixed (**Fig. 7**).

Dicotyledonous Leaves and Palm Phytoliths

Dicotyledonous (hereafter dicot) leaf phytoliths are mostly in the form of polyhedral multicellular structures, tracheid hairs and hair bases. Palm leaf phytoliths are dominated by echinate spheroid/globular morphotypes. These are very distinctive phytolith morphologies, and they are present in almost all assemblages, yet in very low proportions.

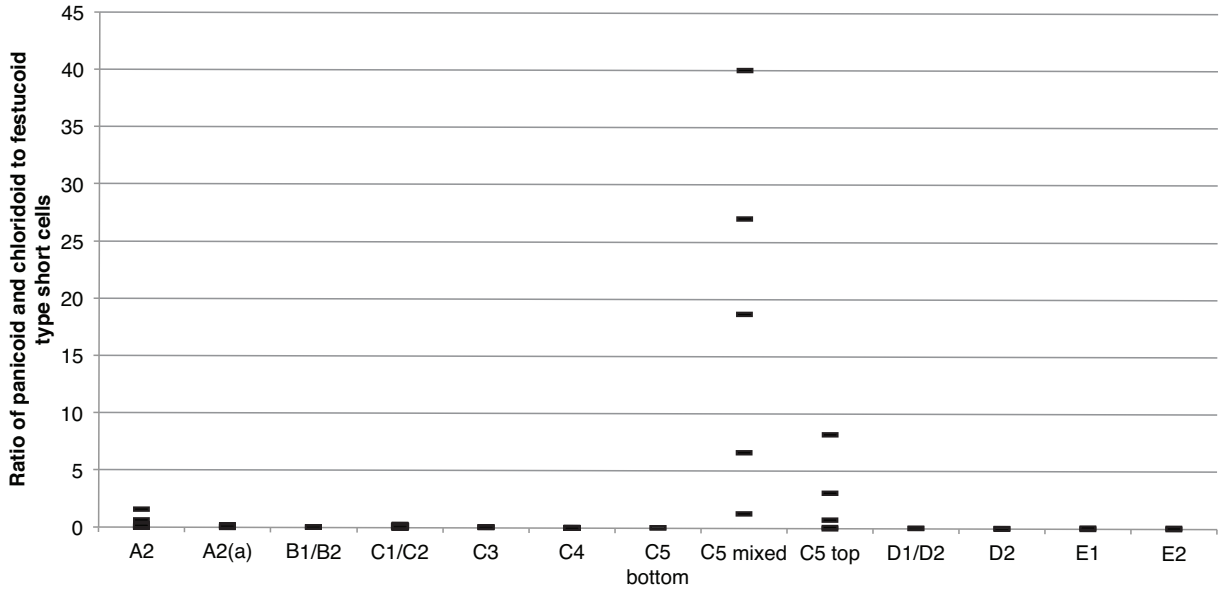

Fig. 6. Ratio of bilobate, cross- and saddle-shaped phytoliths (i.e., panicoid and chloridoid grasses) to rondel and trapeziform (i.e., festucoid grasses) short cells.

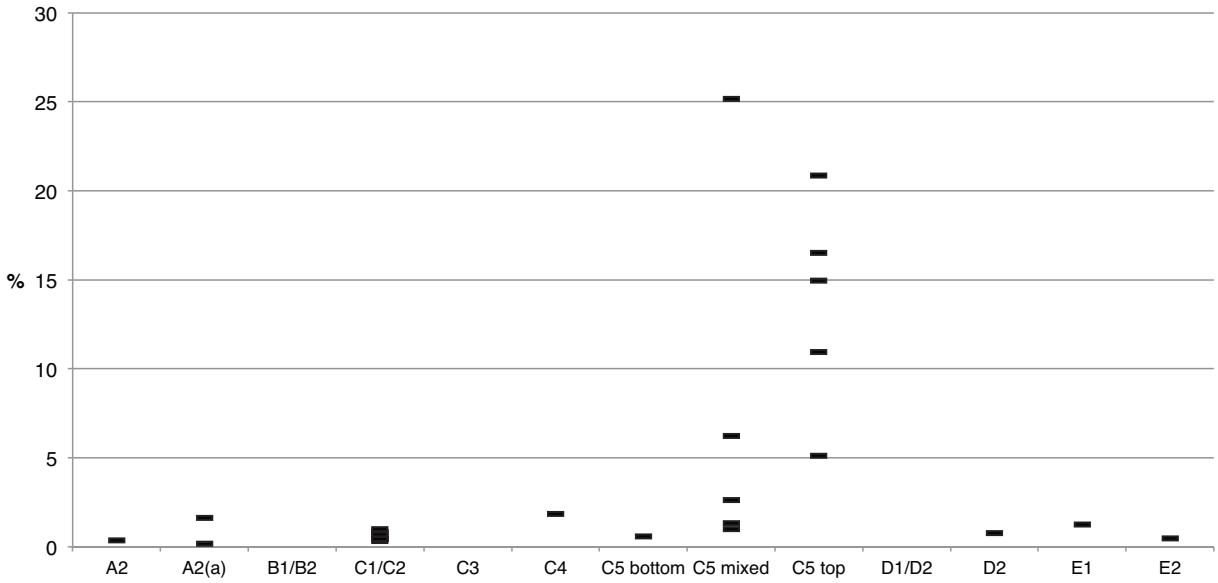

Fig. 7. Percentage of hat-shaped sedge phytoliths.

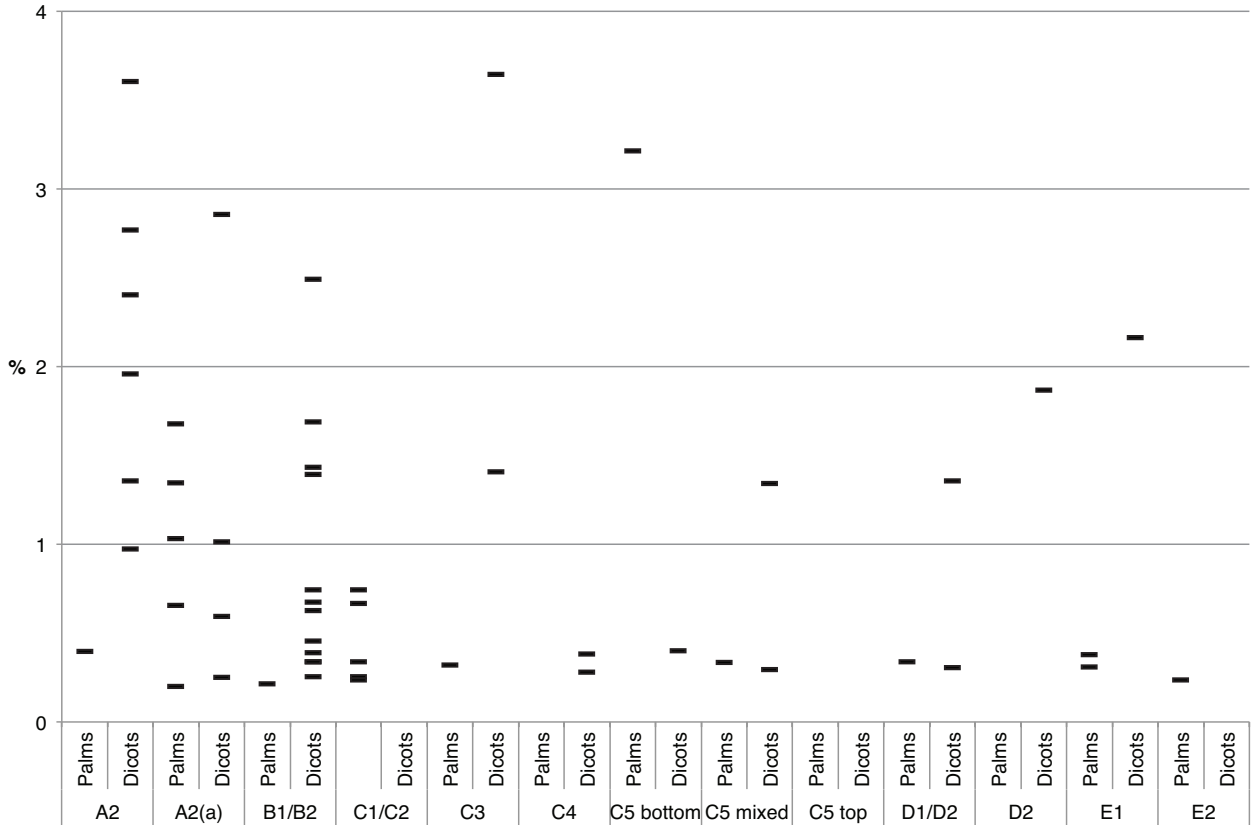

Fig. 8. Percentage of dicotyledonous and palm phytoliths.

Figure 8 presents the percentages of dicot and palm leaf phytoliths in the assemblages studied here, according to microfacies. We note that the highest percentage of palm phytoliths (ca. 3%) was identified in the bottom part of Microfacies C5, possibly indicating that although palms were present in the surroundings of the site, they were not extensively used for construction.

Reference

Albert, R. M.; Shahack-Gross, R.; Cabanes, D.; Gilboa, A.; Lev-Yadun, S.; Portillo, M.; Sharon, I.; Boaretto, E.; and Weiner, S.
2008 Phytolith-Rich Layers from the Late Bronze and Iron Ages at Tel Dor (Israel): Mode of Formation and Archaeological Significance. *Journal of Archaeological Science* 35: 57–75.