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A Palaeoenvironmental Study in Semi-arid Southeastern Spain: the Palynological and Sedimentological Sequence at Perneras Cave (Lorca, Murcia)

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Results are presented of palynological and sedimentological research at the Palaeolithic site of Perneras Cave (coastal Murcia, southeastern Spain). Sedimentological features point to a warm, somewhat humid phase corresponding with the lowermost part of the Mousterian sequence, which was followed by a climatic deterioration which lasted throughout the later Mousterian and Upper Palaeolithic. The palynological study described here barely allows palaeoclimatological inferences to be drawn, but it does highlight interesting paleobotanical data, namely, the presence of Ibero-Maghrebian and Mediterranean elements, which suggest that the site was an important refuge for thermophilous taxa. The reliability of the interpretation of the pollen assemblages is assessed in terms of the incorporation, preservation and distribution of pollen grains into the profile.

Keywords: SOUTHEASTERN SPAIN, PALAEOECOLOGY, PALYNOLOGY, SEDIMENTOLOGY, MOUSTERIAN, UPPER PALAEOLITHIC.

Introduction

In contrast with other regions of the Iberian Peninsula, palaeoenvironmental information is scarce in semi-arid southeastern Spain. Collaborative research into Quaternary palynology and sedimentology has been undertaken further north (Butzer & Freeman, 1968; Fumanal & Dupré, 1983; Dupré, Fumanal & La Roca, 1985; Dupré *et al.*, 1988; Julià, Parra & Esteban, 1987; Carrión, 1992*b*) and, to a lesser extent, in eastern Andalusia (Carrión, 1992*a*).

Palynology at archaeological sites has often been questioned, perhaps because of interpretative difficulties. However, the value of pollen as a potential source of evidence about the past environment in such deposits should not be discounted, especially in arid and semi-arid situations. As pointed out by several authorities (Bryant & Holloway, 1983; Dimbleby, 1985), the challenge lies in distinguishing between cultural activities and palaeoenvironment as well as between palaeovegetation (direct reconstruction) and palaeoclimate (inferential).

This paper presents results of sedimentological and palynological research at the site of Perneras Cave (Murcia, southeastern Spain). The purpose of the study is chiefly palaeoenvironmental, but it also takes into account aspects of the cave stratigraphy. How far pollen and sedimentary materials recovered from archaeological excavations enable us to determine past conditions depends on the actual results obtained: the extent and reliability of interpretations based on such materials cannot be deduced *a priori*. This article tries to stimulate a critical appraisal of the aims of such interdisciplinary palaeoenvironmental research and is as much a discussion as a research report.

Geographical Location, Climate and Present Vegetation

Perneras Cave is south-facing at a height of 105 m above sea level on a ridge of Los Ceperos, a range of

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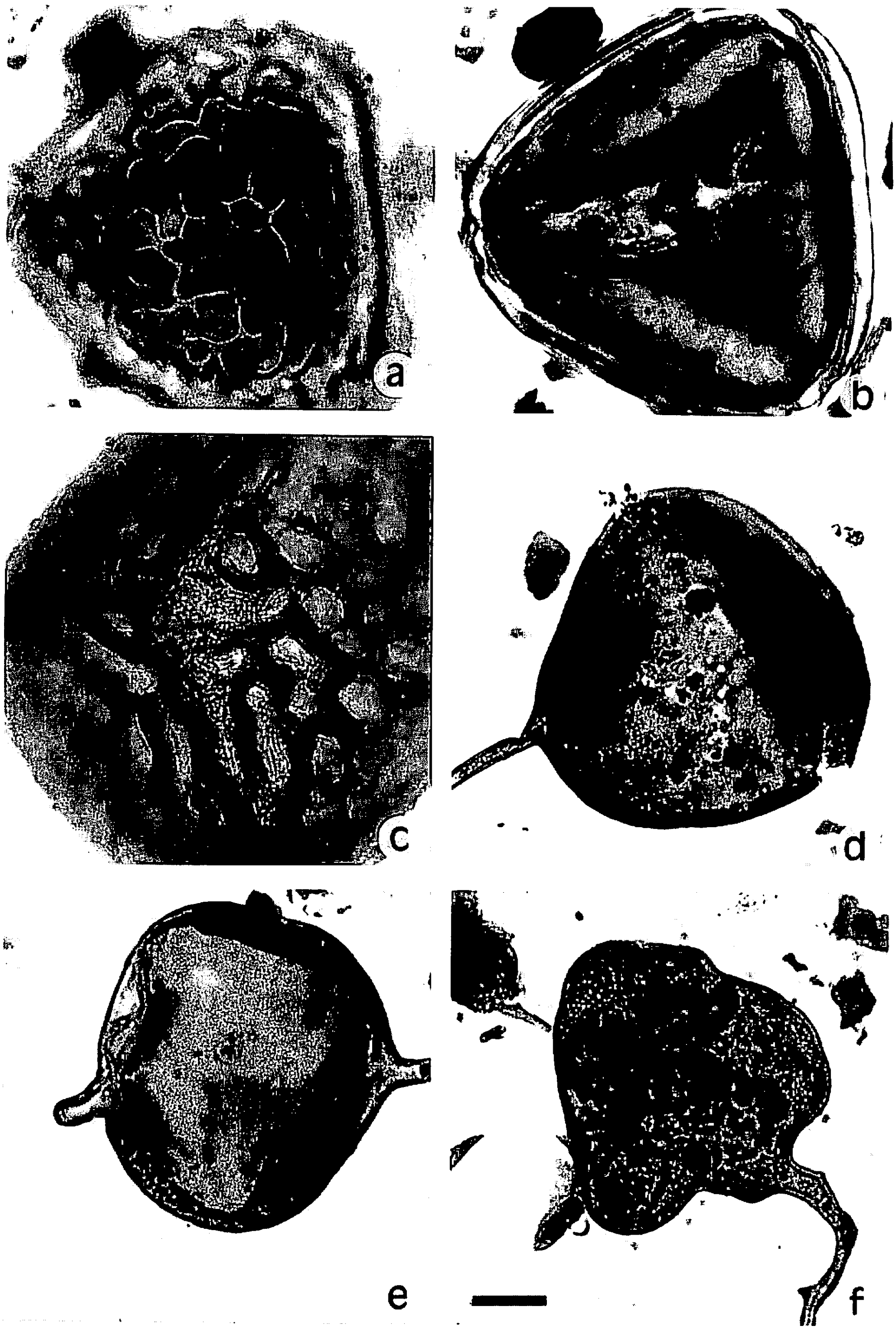

Figure 8. LM micrographs of some pollen types from Perneras Cave. (a, b) *Cosentinia*; (c) *Riccia*; (d, e, f) *Glomus*.

the installation of nitrophilous assemblages. Similarly, human pressure could partially explain the abundance of other taxa such as Asteraceae and Brassicaceae, and even the presence of abundant helio-nitrophilous herbs (Geraniaceae, *Paronychia*, *Asphodelus*, *Malva parviflora*, *Reseda*). A similar hypothesis of Palaeolithic ruderalization has hitherto been put forward by Munuera & Carrión (1991) for the nearby Algarrobo Cave.

Of considerable interest is the relative abundance and nearly constant presence of *Quercus* at Perneras, which lends support to a suggestion that *Quercus*-

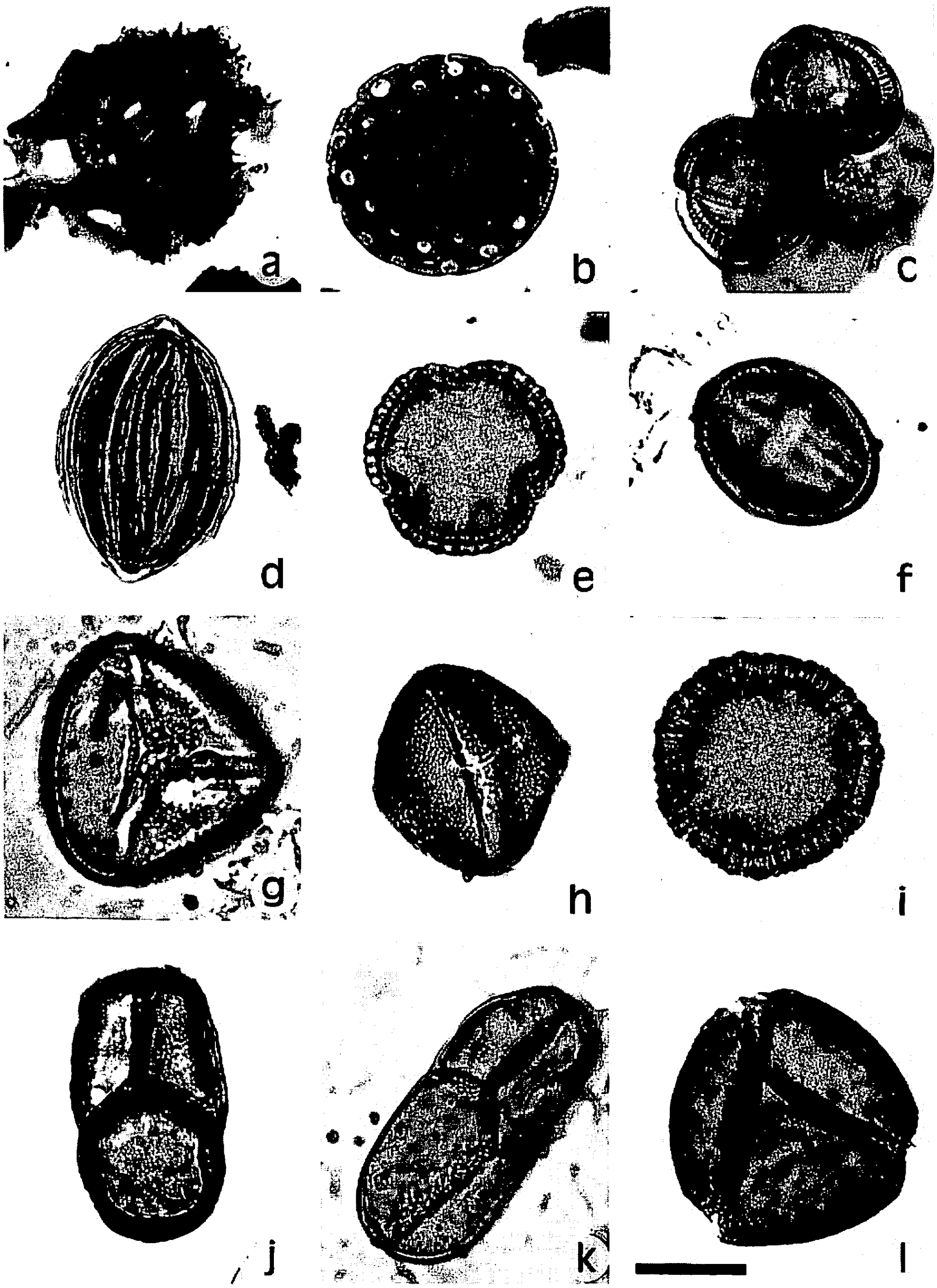

Figure 9. LM micrographs of some pollen types from Perneras Cave. (a) Cichorioideae; (b) Chenopodiaceae; (c) Lump of *Artemisia* pollen; (d) *Ephedra fragilis*; (e) *Olea*; (f) *Osyris*; (g) *Selaginella*; (h) *Lycium*; (i) Thymelaeaceae; (j, k) *Periploca*; (l) *Withania*.

dominated communities, albeit not widespread, were present locally in Mousterian times. Likewise, there are numerous taxa which can be assumed to represent a Mediterranean vegetation similar to that found today near the coast: *Olea, Phillyrea,* Cupressaceae, Rhamnaceae, *Pistacia, Periploca, Osyris, Genista, Ephedra fragilis, Helianthemum, Cistus,* Labiatae, *Ruta,* etc.

Reconstructing ancient climate from these assemblages is complicated. Poor understanding of the factors influencing the *Mayteno-Periplocetum* and *Chamaeropo-Rhamnetum* formations is a major handicap. Although bioclimatic factors could be involved, it is also possible that, in part, they could be favoured by degradation of *Pinus, Quercus* or *Tetraclinis* forests. Studies in the southern Mediterranean demonstrate that the passage of forest to scrub groups can increase resistance to anthropozoogenic influence (Barbero *et al.*, 1990). Evidence of such changes is supported by the testimonies of local elderly shepherds, who have witnessed the spread of spiny leaved shrubs such as *Calicotome* on overgrazed areas, and documentary sources which suggest that tree felling for boat building has been intense during historical times (Sánchez-Gómez, 1990). In conclusion, it is hard to establish whether the present range of coastal xeromorphic scrub is due to increasing dryness during the Holocene, whether it is a result of human influence, or whether both factors have intervened. Much more detailed information is needed about the circumstances affecting the patterns of succession of these communities.

The presence of *Periploca* (Figure 9 (j) & (k)) is noteworthy because of its novelty. In the literature consulted by the present authors, there is no mention of *Periploca* pollen being found in Europe, apart from the occurrence of Asclepiadaceae at Almizaraque, Almería (Mariscal, 1992) which may correspond to *Periploca*. Furthermore, the most likely species involved is *P. angustifolia*, the only Iberian taxon of the genus which is well-known to agriculturalists because it indicates places suitable for cultivation of citrus fruit: that is to say, it is a bioclimatic marker for the absence of frost. Other indicators of warm climate found in the samples are *Osyris, Olea, Pistacia, Myrtus, Withania, Ephedra fragilis, Ruta, Lycium, Thymelaea, Selaginella denticulata, Cosentinia,* etc. (Figures 8 & 9).

Considerable attention has been devoted recently to the biogeography of Quaternary refugia of trees throughout the European continent. Bennett, Tzedakis & Willis (1991) hold that the Iberian Peninsula seems to have been a less important region for refugia than were the Balkans, the Alps or the mountains of Italy and they argue that the greater aridity, smaller massifs and scarcity of palynological data might be responsible for this. In our opinion, the major limitation is that very few records have been examined, especially from Mediterranean contexts. It seems likely that aridity governed the spread of mesothermophilous elements, although the diversity of landscapes in the Iberian Peninsula must surely have provided suitable areas for their development. Perhaps the conclusions of Bennett, Tzedakis & Willis (1991) would have been different if their approach had investigated more than a mere five organogenic deposits (Padul, Valle de la Nava, Sanguijuelas, Sanabria, Comprida) and had included palynological surveys from caves, rockshelters and palaeosols. Many studies have now been published based on Spanish sites that show the presence of abundant mesothermophilous trees during stages when northern Europe underwent last-glacial conditions: Lezetxiki Cave (Sánchez-Goñi, 1992), Atapuerca Cave (García-Antón & Sainz-Ollero, 1991), Carihuela Cave (Carrión, 1992*a*), Algarrobo Cave (Munuera & Carrión, 1991), Cova Beneito (Carrión, 1992*b*), Cova Malladetes (Dupré, 1988), Pla de l'Estany (Pérez-Obiol, 1988; Burjachs, 1990), Cova de l'Arbreda (Burjachs, 1987), Abric Romani (Burjachs & Julià, 1992), Banyoles (Pérez-Obiol & Julià, 1992), and Lake Llauset (Vilaplana, Montserrat & Schlüchter, 1989), etc.

A broad reading of these studies of the evolution of Iberian forests during the Quaternary suggests that the vegetational complexity of the Peninsula is connected with the existence of refugia (Costa-Tenorio *et al.*, 1990). The presence of north African floristic contribution is significant, at least for southeastern Spain, and it is worth remembering that the Iberian "subcontinent" has afforded a geological link between Africa and Europe since the early Cretaceous.

Conclusions

From the typology of the palaeolithic industry found, the only possible chronological attribution for the Perneras cave deposit reported here is that it belongs in the middle to upper part of the Upper Pleistocene (Montes, 1989). A more detailed date is not possible with the present data. The sedimentary features suggest relatively little variation in depositional conditions, and both the Mousterian and the Upper Palaeolithic beds are poorly differentiated palynologically. Pollen biozone B might reflect, however, a more open landscape than that of the preceding Mousterian pollen biozone A. This possibility would agree with standard interpretation of the presence of considerable aridity during oxygen-isotope stage 2 in the Mediterranean region. Whatever the case, a long Upper Pleistocene sequence is still needed before an accurate chronostratigraphy can be established for the semi-arid region of southeastern Spain. In conclusion, in this work we have been able to present some palaeobotanical novelties and to discuss some palaeovegetational issues, but we have been unable to do more than merely refer to the palaeoclimate. We have not been able to produce a precise geochronological framework for the site.

The data presented here, regardless of local considerations, lend support to the hypothesis that, from a pollen-analytical perspective, Mousterian and Upper Palaeolithic layers can and should be differentiated. While the Mousterian pollen record suggests conditions for chemical and stratigraphical stabilization and, therefore, could be reliable, the Upper Palaeolithic pollen record shows features that indicate pollen deterioration, differential preservation, contamination, downward movement and reworking. Perneras may exemplify many of the limitations and possibilities associated with using cave sediments for palaeoecological interpretation.

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Appendix

The following pollen taxa are included in the groupings of the Figure 7:

OTHER ASTERACEAE: Cichorioideae, Asteroideae, *Centaurea*. OTHER HERBS: Brassicaceae, Geraniaceae, *Paronychia*, Caryophyllaceae, Apiaceae, *Rumex*, Polygonaceae, *Lotus*, *Lathyrus*, Fabaceae undiff., Dipsacaceae, *Allium*, *Asphodelus*, Liliaceae undiff., Campanulaceae, *Malva parviflora*, Polygalaceae, *Reseda*, *Thalictrum*, *Fumaria*, Sanguisorba, *Nuphar*.

OTHER MEDITERRANEAN SHRUBS: Rhamnaceae, *Pistacia*, *Myrtus*, *Erica arborea*, *Buxus*, *Hedera*, *Periploca*, *Osyris*, *Withania*, *Lycium*, *Ephedra fragilis*, *Genista*, *Ononis*, *Cistus*, *Helianthemum*, *Ruta*, Thymelaeaceae, Lamiaceae, *Sideritis*.