A NEW METHOD FOR EXTRACTING PLANT AND INSECT FOSSILS FROM LEBANESE AMBER

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ABSTRACT. The extraction of fossil plants and insects from Lebanese amber is possible by dissolving the amber in chloroform. The fossils can be prepared like Recent material and mounted in Canada Balsam. This method enables better observation of the morphological details of the fossils.

LEBANESE amber, well known as the oldest amber with insect inclusions (Whalley 1980; Poinar 1994), is found in various outcrops in Lebanon: Jezzine, Daher El Baidhar, Safa (pers. discovery), Barouk (pers. discovery), Ghineh (pers. discovery), Bireh, Ain Treize, Mayrouba, Mdeirij/Hammana and Kfar Niss.

The amber used for the present study comes from Mdeirij/Hammana and is preserved in clay-sandstone from the upper Neocomian–basal Lower Aptian C1/C2, *c.* 120 Ma (Dubertret 1951, 1955; Schlee and Dietrich 1970; Schlee and Glockner 1978). Although insects are very common at this outcrop, their presence has not yet been reported in the literature. Lebanese amber is supposed to be formed from araucarian conifers (Cano *et al.* 1993) and usually occurs as very small pieces, less than 1000 mm^3. Inclusions are commonly very difficult to study because of the presence of dark zones and of numerous impurities in the amber. A new method of extraction of the various inclusions has therefore been developed to improve the study of such material.

Extracting fossil organisms has been attempted by Galippe (1920) from various types of amber (Cenomanian of France, Upper Eocene Baltic amber, Miocene French amber from Savoie and some African Recent copal). He noticed that after immersion in ether for four days the amber became smooth and could be cut into small fragments but was not completely dissolved. Larsson (1978) noticed that alcohol softens and partly dissolves Baltic amber, but that the fossils were destroyed with the amber.

Although successful attempts to extract DNA from a weevil (Coleoptera: Nemonychidae) in Lebanese amber have been made by Cano *et al.* (1993), the direct extraction of fossils has never been achieved. It seems that the great majority of fossil insects and plants from Lebanese amber are true inclusions with well-preserved organic remains, unlike Baltic amber.

METHOD OF EXTRACTION

Lebanese amber was washed with a mixture of water and Javel water (NaClO) which facilitated clay suspension. Pieces of the amber were examined under immersion in glycerin (Whalley 1980) or alcohol (60 per cent.) plus glycerin (40 per cent.); the alcohol spread through cracks in the amber and gave better visibility. After selecting pieces with inclusions, these were filed down with emery paper (no. 400, 500 and 600 metal; Akra, pers. comm.; Melky, pers. comm.) until the amber became transparent; then a coat of acetone varnish or Canada Balsam was put over the samples. The finest details of the insects could then be clearly seen, allowing identification of the material. Examination under cedar oil gave satisfactory results.

First attempts at extracting plant and insect remains were made using heat, without success; when the amber was exposed to a heat source, it cracked and burnt. Eventually, organic solvents were tried. Some of them were ineffective (ethanol, butanol). Others made the amber soft (aceton,

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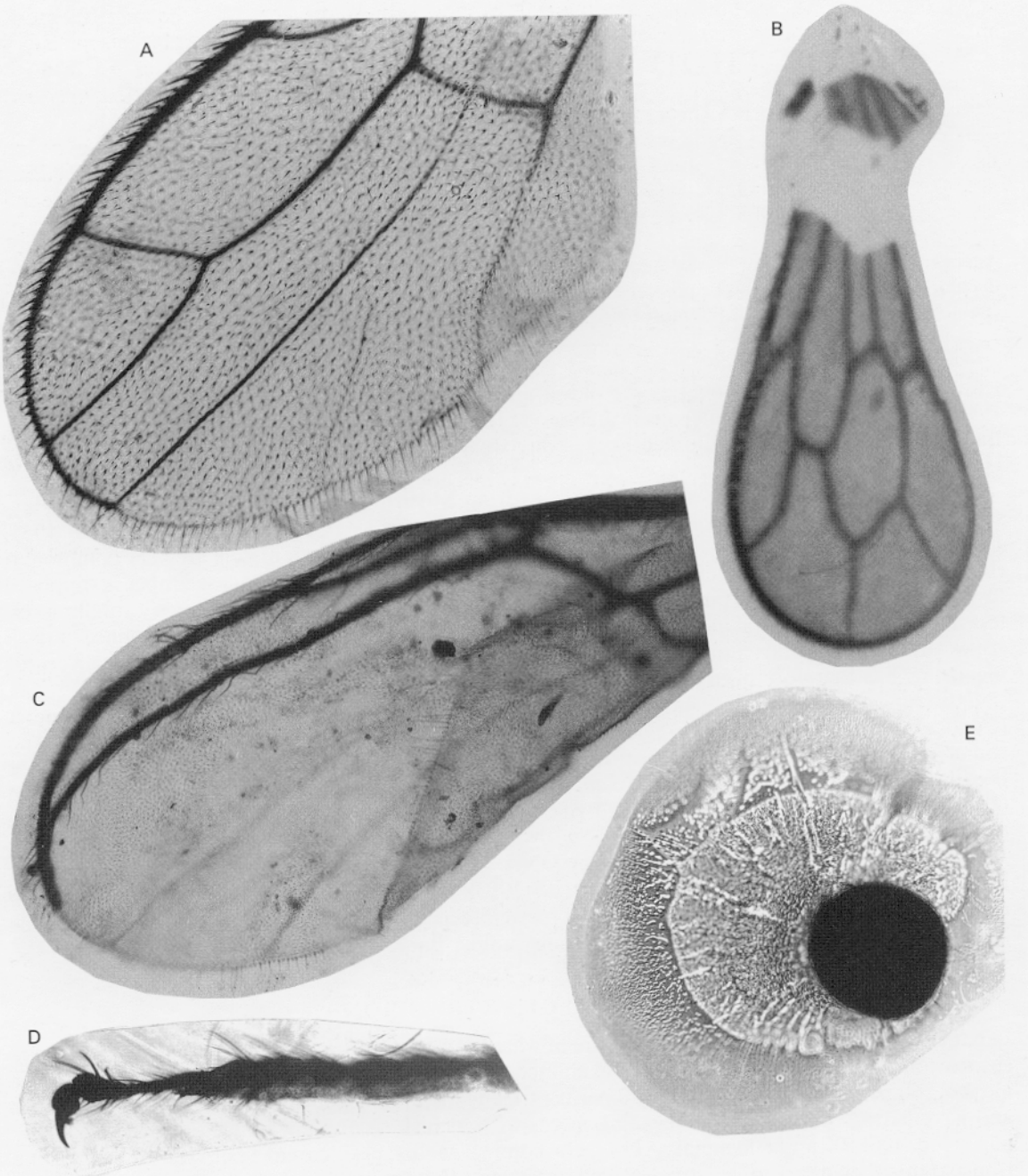

TEXT-FIG. 1. Examples of fossil dissolved out of Lebanese amber using chloroform; Mdeirij/Hammana, Lebanon; upper Neocomian–lower Aptian. A, wing fragment of fly (Diptera: Empidae?); ×160. B, wing fragment of a hemipteran (Enicocephalidae); ×60. C, wing of fly; ×135. D, fragment of insect; ×35. E, undetermined seed; ×85.

toluen, trichloro- 1, 1, 1 ethan). Only chloroform gave satisfactory results, dissolving the amber in less than two hours. The amber was put in chloroform in a completely sealed receptacle, to avoid evaporation of the solvent. The plant and insect remains flocculated and settled from the solution and were prepared on microscopic slides in Canada Balsam. Until now, we have only used imperfect fragments in order not to lose good specimens.

Articulated fragments of the insects from amber were fragile but, with some care, the specimens could be extracted in their entirety (Text-fig. 1A–D). The method gave excellent results for the direct study and manipulation of insect structures such as wings, heads, abdomens and genital apparatuses. Extracted fossils keep their softness as well, just as if they were freshly collected. Putting plant residue in Javel water for 30–60 minutes clarified the tissues for mounting on microscopic slides (Text-fig. 2E). Plant cells and even nuclei were then visible.

The dissolved amber can be recovered by exposing the solution to open air for several days, but the amber will not regain its initial properties. Small amber fragments can be assembled into bigger ones using a small quantity of chloroform.

The present method is of great interest for the future study of the insect fauna of the Lower Cretaceous amber of Lebanon because it allows the direct examination of the fossils. It becomes possible to observe the finest structures, which are otherwise often very difficult to see. Also, fossil material is directly accessible for DNA analysis, with a minimal risk of contamination. It would be very interesting to verify if ambers from other origins could also be dissolved in chloroform.

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REFERENCES

CANO, R. J., POINAR, H. N., PIENIAZEK, N. J., ACRA, A. and POINAR, G. 1993. Amplification and sequencing of DNA from a 120–135-million-year-old weevil. *Nature*, **363**, 536–538.

DUBERTRET, L. 1951. *Carte géologique à 1/50000 du Liban, feuille de Beyrouth.* Ministère des Travaux Publics, Beyrouth.

—— 1955. *Carte géologique à 1/50000 du Liban.* Ministère des Travaux Publics, Beyrouth.

GALIPPE, V. 1920. Recherches sur la résistance des microzymas à l'action du temps et sur leur survivance dans l'ambre. *Comptes Rendus de l'Académie des Sciences, Paris*, **170**, 856–868.

LARSSON, S. G. 1978. Baltic amber – a palaeobiological study. *Entomonograph*, **1**, 1–192.

POINAR, G. O. 1994. Fossils in amber. *Current Science*, **66**, 417–420.

SCHLEE, D. and DIETRICH, H.-G. 1970. Insektenführender Bernstein aus der Unterkreide des Labenon. *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*, **1**, 40–50.

—— and GLOCKNER, W. 1978. Bernstein. *Stuttgarter Beiträge für Naturkunde, Reihe C*, **8**, 1–72.

WHALLEY, P. E. S. 1980. Neuroptera (Insecta) in amber from the Lower Cretaceous of Lebanon. *Bulletin of the British Museum (Natural History), Geology Series*, **33**, 157–164.

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