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一种观察被子植物压膜化石细微叶结构特征的有效方法*

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关键词　压膜化石　细微叶结构　方法

被子植物叶化石的研究已有一百多年的历史。传统的研究方法一直是以叶宏观特征(leaf gross feature)为依据的“对图版”方法(“picture-matching” method)，即寻找宏观特征与化石叶相似的现代植物叶，作为对化石叶进行分类和命名的基础和依据。这种方法其结果的可信度缺乏保障，甚至经常导致错误的结论(Dilcher，1974；Kvacek and Walther，1978；Iljinskaja，1978)。

Hickey 等归纳、总结的叶结构分析法(leaf architectural analysis)将叶的宏观特征和诸如细微叶脉、齿型、腺体等方面的细微特征密切地结合起来，揭示了一系列在分类上具有稳定性的性状，提高了被子植物叶的分类学研究的可信度(Hickey，1971，1973；Hickey and Wolfe，1975；李浩敏，1987)。这种方法在化石叶研究领域中的运用也为提高被子植物叶压膜化石分类、鉴定的准确性、科学性提供了可能。然而，由于叶压膜化石保存的局限性，其细微叶结构特征，尤其是细微叶脉特征往往难以观察到。Dilcher(1974)曾介绍过在压膜化石上观察细微叶结构特征的处理方法，但仅适用于保存条件相当好的化石。例如，Smiley 和 Huggins(1981)和 Horiuchi(1996)曾分别利用将保存良好的叶化石制成透明叶(cleared leaf)和/或半透明叶(transluscent leaf)的方法获取细微叶结构特征，取得良好的观察效果。然而，他们所研究的叶化石的保存状态之好是比较罕见的。对于不具备可制成透明叶或半透明叶保存条件的叶压膜化石，其细微叶结构特征的观察往往依赖于研究人员的观察力甚至猜测，往往导致不精确的结果。有没有一种方法可以在不将化石叶制成透明叶或半透明叶的情况下精确观察到细微叶结构特征呢？

笔者在对叶压膜化石角质层进行制备的过程中发现了这样一种方法。在采用常规的次氯酸钠溶液浸解法(Dilcher，1974；叶美娜，1981)对化石角质层进行制备的过程中，笔者发现，次氯酸钠溶液在浸解角质层所依附的腐殖物(humus/humics)之前首先使除叶脉之外的部分变成透明或半透明状。此时如果使浸解反应暂时停止，即可清晰地观察并记录下化石叶的细微叶脉特征。

具体步骤如下：从叶化石特定部位取下一块，清除(用 HF 及清水等)基岩及其它杂质后，浸入适当浓度(依化石保存条件而定)的次氯酸钠溶液中进行浸解。浸解过程中不断观察以防止浸解过度。该过程可持续数分钟至数小时不等。一旦发现化石叶片变成透明或半透明状，立即用清水充分置换次氯酸钠的溶液使浸液反应暂时停止，利用解剖镜及光学显微镜对该标本显示的细微叶结构特征进行观察。观察之后可将该标本进行常规封片保存，也可再用次氯酸钠溶液置换清水让浸解反应继续进行，并不会影响角质层制备的效果。

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AN EFFECTIVE METHOD OF OBSERVING FINE VENATION FROM COMPRESSED ANGIOSPERM FOSSIL LEAVES

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Summary

The traditional "picture-matching" method of identification of angiosperm fossil leaves based mainly on gross leaf features has often led to unjustifiable conclusions (Dilcher, 1974; Kvazek and Walther, 1978; Iljinskaja, 1978). As generally accepted, it is necessary to study the fine venation, cuticular characters and gross leaf features of fossil leaves as well if the preservation permits. For compressed fossil leaves, the gross leaf features can be circumscribed by naked eyes and/or under dissecting microscope (DM), and their cuticular characters can also be observed by using standard methods reported by Dilcher (1974), Ye (1981), and others. However, it has long been aware that fine venation is usually hard to observe. Only well preserved specimens can be treated with the procedures introduced by Dilcher (1974). For example, Smiley and Huggins (1981) and Horiuchi (1996) applied respectively the techniques of making cleared leaves and transluscent leaves from well preserved fossils for observing characters of fine venation. Unfortunately not all preservations are good enough to make cleared leaves or transluscent leaves. For those fossil leaves which are unfavorable to prepare cleared or transluscent leaves, their observation is somewhat upon the interpretation or even conjecture of the observer. How can fine venation be precisely observed from such kind of leaf compressions?

During the maceration of Miocene compressed leaves collected from NE China, the author found that the veins were the last to be macerated. Thus, if the maceration process is held under careful inspection, the details of the fine venation could be observed by stopping the process at a proper time. For example, when preparing cuticles with sodium hypolorite solution (Dilcher, 1974; Ye, 1981), the fine venation could be distinctly detected under DM or light microscope (LM) by changing the solution thoroughly with water when most of the material, apart from the veins is macerated. After observation, the material can be either mounted on slides for permanent preservation or put back into the sodium hypochlorite solution to continue maceration.