EXPANDING EVOLUTIONARY KNOWLEDGE USING MOLECULAR FOSSILS

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The direct relationship of certain molecular fossils (biomarkers) to particular taxa has been verified in two ways: by studying the natural product chemistry of extant organisms, and by surveying the geologic record for specific biomarkers. Several biomarkers that show a chemical relationship to extant taxa have been correlated with their fossil records in the Phanerozoic and late Proterozoic Eons. Oleananes, are revealed as markers for angiosperms, dinosteranes (and related triaromatic dinosteroids) for dinoflagellates, triaromatic 23,24-dimethylcholestanes for dinoflagellates and haptophytes, 24-norcholestanes for diatoms, and 24-isopropylcholestanes for porifera. Organic matter in sedimentary rocks comes mainly from the soft parts of organisms, and therefore, compliments the geological record of the structurally more durable parts, such as skeletal fossils. New perspectives on the history of these taxa have been revealed. The taxon-specific biomarkers are invariably found to pre-date the oldest known fossils for a given taxon. Thus, pre-Cretaceous oleanane may represent angiosperms and pre-date their definitive plant fossils. Ancient dinosteroid occurrences and dinosteranes associated with certain acritarchs verify dinoflagellate roots among the acritarchs. Early occurrences of 24-norcholestanes may indicate a long prehistory of currently undiscovered diatoms or closely related algae, and the finding of abundant 24-isopropylcholestanes in Vendian rocks and oils presaged the discovery of Vendian sponges. Petroleum is a pooled product of organic matter. Therefore, biomarkers generally abundant in oil are an independent source of information about its biologic, geologic and environmental history.