i17 Permian flora of Southern Laurasia < drought tolerant >

HIC JACET IN TUMBUA / ROSA MUNDI NON ROSA MUNDA / NON REDOLET SED OLET / QUAE REDOLERE SOLET —translated by John Speed (1552-1629) as:
'This tomb doth contain the world's most beautiful Rose, passing sweet erewhile,
Now nought but odour vile.'[1]

During the Permian, continuing differential movement between the Southern Laurasia and Gondwanaland realms of Pangea-to-be, maintained high mountainous terrain along the line of their suture. (These realms before the Pennsylvanian, were the ORS and Gondwana paleocontinents, respectively.)[2] This Permian intracontinental mountain chain just south of the paleoequator, and a Paleotropic of Capricorn desert zone south of it, were together a biological barrier that kept gondwanide flora isolated to its south.

On the north side of the intracontinental mountain chain, Permian flora of the Southern Laurasia realm were genera selected for their resistance to alternating seasons of rain and drought in tropical through subtropical latitudes.[3] The Late Permian Hermit shale, exposed in the Grand Canyon, records this climate regime: thin beds of blood-red (oxidized) sandy shales and silts that are either with numerous current ripples, or are deeply mud cracked and have casts of salt crystals. The Hermit shale flora are mostly xerophytes (plants structurally adapted to cope with a restricted water supply) such as *Supai* (a presumed seed fern) and, possibly, some conifers.[4]

Sphenobaiera, known from Late Permian strata of Southern Laurasia, is the oldest member of the Ginkgo line. Its leaf is broadly wedge-shaped and is without a distinct petiole.[5]

Less extreme Southern Laurasian "Permian" conditions are recorded by the "Red Beds" of Texas. In these are found gymnosperms that are common fossils in similar Permian strata throughout Southern Laurasia. These "index fossils" are Early Permian seed ferns *Gigantopteris* and *Calliptcris*. But these genera were also in existence during the Pennsylvanian. However, they were then a minor component of the flora.

Gigantopteris, a vine with stems less than a centimeter thick, was named for its foot wide, several-feet long, leaves. These, Hongqi Li found in 1983, have vessels (specialized cells, with perforated walls where these touch, for moving water up stems to leaves).[6] Vessels transport water more efficiently than can tracheid cells. The first-known flowering plants, from about 120 Ma, had these cells. More primitive higher plants make do with tracheid cells.[7] The discovery of vessels in 270 My *Gigantopteris*, however, does not indicate that flowering plants evolved from it. Just another example, according to Edith Taylor, of parallel evolution that was "a physiological adaptation to solve the problem of supplying water to huge leaves through comparatively small stems." [8]

Conifers such as *Lebachia* and *Walchia* are common Permian fossils of Southern Laurasia. They are also known to occur in strata with typical Pennsylvanian flora.

To quote Chester A. Arnold: "The early Permian flora is essentially an extension of that of the Late Pennsylvanian, and in many places no sharp division between the two can be drawn." [9]

By contrast, in Gondwanaland where an extensive ice sheet persisted to near the end of the Early Permian, the (gondwanide) flora was distinctive in being cold adapted.[10] ❑