Chapter 5

Paper:

Rydin, Catarina, Barbara Mohr, and Else Marie Friis. "Cratonia cotyledon gen. et sp. nov.: a unique Cretaceous seedling related to Welwitschia." *Proceedings of the Royal Society of London. Series B: Biological Sciences* 270, no. Suppl 1 (2003): S29-S32.

Questions:

1. **What are Gnetales?** ANSWER: Gnetales are a major clade of Gymnosperms which includes three extant genera, *Gnetum*, *Ephedra* and *Welwitschia*. They are considered by some to be a monophyletic group but by others to be nested within the conifers. The fossil record of the group has been poorly known until recently as indicated by this paper.

2. **Describe the general morphology of polyplicate pollen.** ANSWER: This pollen type has longitudinal ridges and valleys.

3. **Living Gnetales are a relatively low diversity group. However, palaeobotanists hypothesize that they were much more diverse in the geological past. What are the main arguments used to support this hypothesis?** ANSWER: The three living genera show very pronounced morphological and ecological differences which suggest that they may have had a much wider geographical distribution in the past. The fossil pollen record of Gnetales supports this as pollen is found widely across low (tropical) to middle (subtropical) palaeolatitudes in sediments ranging in age from ~ 140 (early Cretaceous) to 90 (mid Cretaceous) million years old.

4. **The fossil plant described in the paper is a new genus and species (gen. et sp. nov.) to science. A very formal description of the new genus and species is presented. Why is this and what procedure is followed in palaeobotany to describe new genera and/or new species?** ANSWER: The authors first established by comparison with other known fossil plants that the new fossil specimen was indeed a new genus and species that had never been described in a formal published paper. Next the authors followed the procedure laid down by the International Code of Botanical Nomenclature (ICBN), now known as the International Code of Nomenclature for algae, fungi and plants (Melbourn code: http://www.iapt-taxon.org/nomen/main.php) to formally describe the specimen under the following headings; systematics, (a) Etymology (which describes the origin of the newly given genus name), (b) generic diagnosis (detailed description of the morphology and anatomy visible on the new genus, (c) Type (name of the specimen on which the new species description is based), (d) Specific diagnosis (detailed description of the morphology and anatomy visible on the new species), (e) Etymology (describes the origin of the new species name), (f) Holotype (g) Locality (details of where geographically the species was discovered) and (h) Stratigraphic position (details of the geological formation in which the specimen was found and the position within that formation).

5. **What morphological feature of the new fossil is characteristic of living *Welwitschia* and why is it significant that both fossil *Cratonia* and living *Welwitschia* possess this trait?** ANSWER: The secondary venation pattern of both taxa form distinctive Y shaped patterns which are not known from any other living species according to the authors. This is significant and interesting because it provides further morphological data suggesting a close evolutionary affinity of *Cratonia* with living Gnetales.

6. **What other morphological traits are observable in the fossil which are also only found today in Gnetales?** ANSWER: A structure interpreted as an 'embryo feeder' is present in the fossil *Cratonia* which is also found in living *Gnetum* and *Welwitschia* but not in *Ephedra*. The function of the feeder is thought to be for water absorption during early seedling development.

7. **What is the broader significance of the discovery of *Cratonia cotyledon* for understanding plant evolution?** ANSWER: The discovery of *Cratonia cotyledon* is highly significant for piecing together the evolutionary history of the Gnetales. Because it shares more morphological traits with *Welwitschia* than any of the other living Gnetales it pushes back the *Welwitschia* lineage to the Aptian–Albian of the Cretaceous, around 120 million years ago. Furthermore, the discovery of *Cratonia* in Brazil in South America in Aptian–Albian aged deposits suggests that the *Welwitschia* lineage had a geographical distribution beyond that of the modern day where it is geographically restricted to the Namibian desert in Africa.