Chapter 8

Paper:

Claire M. Belcher, Luke Mander, Guillermo Rein, Freddy X. Jervis, Matthew Haworth, Stephen P. Hesselbo, Ian J. Glasspool, and Jennifer C. McElwain. "Increased fire activity at the Triassic/Jurassic boundary in Greenland due to climate-driven floral change." *Nature Geoscience* 3, no. 6 (2010): 426-429.

Questions:

1. **Why does increased global temperature result in an increased prevalence of wildfires?** ANSWER: According to the authors and other studies, increased global temperature results in increased upper tropospheric water vapour content which in turn increases the likelihood of storms. Storminess increases lightning frequency, which is the major ignition source of natural wildfires.

2. **What is the main aim of the paper?** ANSWER: To investigate fire activity across the Triassic-Jurassic boundary of east Greenland using fossil charcoal as a proxy for wildfire.

3. **What is a Global Boundary Stratotype Section and Point (GSSP)? Where is the GSSP for the Triassic-Jurassic (T-J) boundary? Why was it important to correlate the Greenland section with the T-J GSSP?** ANSWER: A GSSP is the reference point that defines the lower boundary of a stage, in this case the lower boundary of the Hettangian Stage of the Jurassic. The GSSP defining the base of the Hettangian Stage is situated at the Kuhjoch Pass, Karwendel Mountains, Austria and is marked by the first occurrence of the ammonite *Psiloceras spelae tirolicum*. It is important to correlate Greenland to the GSSP so that it can be correlated with all other studies on the Triassic-Jurassic boundary interval and be placed in the broader global context of events occurring during this time.

4. **What trend in fire activity is inferred from the proxy charcoal record?** ANSWER. Fire activity was relatively low in the latest Triassic but increased five-fold across the Triassic –Jurassic boundary interval, falling back to pre-excursion levels sometime in the Hettangian later in the section at plant fossil bed 7.

5. **What factors can potentially bias the fossil record of charcoal and how have these biases been minimized or eliminated in this study?** ANSWER: The setting or environment of original sedimentation, known as the 'depositional environment', into which the charcoal was washed during or following the wildfire event can influence charcoal abundance. In other words, some depositional settings can increase the likelihood of charcoal preservation compared with others which would bias interpretation of trends in the abundance of fossilized charcoal. The authors have addressed this bias by highlighting that similar changes in the charcoal abundance patterns are also observed in Poland, suggesting that the trends observed in Greenland are not local but reflect a much wider regional pattern of change in wildfire activity.

6. **How can vegetation influence fire activity?** ANSWER: Plant biomass is fuel for fire. Therefore the quantity, structure, chemistry, connectivity and distribution of species and vegetation communities can all influence fire activity.

7. **How did the authors investigate the potential influence of Triassic-Jurassic vegetation on palaeo fire activity?** ANSWER: First the authors divided the palaeovegetation into broad leafed and narrow leafed categories for each fossil plant bed preserved in the Astartekloft section in East Greenland. Next, nearest living ecological equivalents of the Triassic –Jurassic vegetation were tested for their flammability using a fire propagation apparatus calorimeter. This investigation demonstrated that narrow leafed species burn faster, hotter and released more total hydrocarbons than their broad leafed counterparts. In combination, the authors were able to demonstrate that the vegetation of the earliest Jurassic was therefore considerably more flammable than the vegetation of late Triassic because it was made up of a higher proportion of narrow leafed forms.