Abstract presented during an international meeting “New insights into Palaeobotany” Liège, December 13-16, 2006, as a contribution to Muriel Fairow-Demaret retirement. The content largely relies on the two lectures given during the last Geological Society of America meeting at Philadelphia (USA), see Streele & Isaacson (2006) and Streele & Traverse (2006).

**West Gondwanan and Euramerican climate impact on early Famennian to latest Viséan miospore assemblages**

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Accurate Upper Devonian biostratigraphy is based on conodonts, marine microfossils. Dating non-marine or marine deposits which do not contain conodonts, often depends on miospores, which are produced in huge quantities by terrestrial plants and are abundantly dispersed in contemporaneous marine sediments. Most of the correlation between conodont and miospore stratigraphies has been established in Western Europe, notably in the Ardenne-Rhine area. Because the same Frasnian and Famennian miospore zones (the Cymbosporites Realm in Streele & Marshall 2006) occur in both Southern Euramerica and Western Gondwana (implying close proximity of these continents) they allow transfer of Southern Euramerica conodont stratigraphy to Western Gondwana. When reconciling the Famennian conodont and miospore zones with the new, now widely accepted chronostratigraphy (Kaufmann 2006) and using the substage nomenclature proposed by Streele et al. 2000 and Streele 2005 (Fig. 1), three steps are recorded which might be climatically controlled (1 to 3). Climatic and/or tectonic control is also obvious during the Mississippian (4).

1) In Southern Euramerica, the Lower-Middle Famennian vegetation crisis (at least 5 Myr) corresponds to very poorly diversified miospore zones (Raymond & Metz 1995, Streele et al. 2000). This crisis seems to extend stratigraphically to the Upper Famennian in cold temperate to subpolar Western Gondwana and may be therefore climatically controlling.

2) The Upper Famennian miospore zones are based on a succession of species of *Grandispora* occurring in the same stratigraphic order in western and eastern Europe (Higgs et al. 2000). The bases of the Upper Famennian VC0 and VH miospore Zones in USA (Richardson & Ahmed 1988) are poorly controlled by marine fossils which often occur as single specimens at long distance from rich miospore assemblages (Streele & Loboziak 1994). Correlation is then based on lithostratigraphy despite their diachronous character. Maybe, however, a belated arrival of VC0 and VH characteristic miospores in the Upper Famennian of Belgium could have been controlled by the arid climate (Streele & Marshall 2006) if rain-bearing winds were deflected into Gondwana as proposed in the Tournaisian by Wright (1990). This alternative is called here the Upper Famennian correlation challenge (at least 5 Myr). Tectonic control of regional climates may be inferred in mapping the unconformities around the Old Red Continent. During the Upper and Uppermost Famennian characteristic conodont taxa (Kaiser 2005) show shorter stratigraphic ranges and are more numerous than characteristic miospores. Both microfossils mark an obvious turnover near the Upper/Uppermost Famennian limit.

3) Glacial and interglacial cycles, during a period called here the quick changing climate Uppermost Famennian (less than 3 Myr), are quite evident after the sharp climate change occurring during the late Upper Famennian within the Middle *expansa* Zone and introducing a new, almost cosmopolitan vegetation belt characterized by the miospore *Retispora lepidophyta*. But the best documented part is obviously the Uppermost Famennian age, when glacial deposits containing the LE-LN Zones reached the sea-level in Western Gondwana. Based on miospore (and locally on acritarch) quantitative data, cycles are very obvious in arid equatorial (Greenland) as well as in tropical (Ardenne-Rhine) regions (Streele & Marshall 2006). They allow also very detailed correlation of the Hangenberg Crisis (Streele 1999, Kaiser et al. 2006), in the Middle to Upper *praesulcata* Zone, with new geochemical data from tropical (Western Europe) and subtropical (Southern France and Morocco) regions and detailed correlation with warm temperate subtropical Pocono Fm (Pennsylvania) and the glacial events in Western Gondwana (South America).
4) Late Middle to early Late Tourmaisian rare glacial evidences in Western Gondwana might correspond to mountain glacier at proximity of the Eocercylian uplift of the Andean Range. Upper Viséan (Holkerian-Asbian or late Meramecian) rocks in Western Gondwana have also some glacial evidences but might sometimes display a very Warm-Temperate Floral Belt (Alleman & Pfefferkorn 1988). This apparent paradox is explained by alternation of mean temperatures during 4 My as demonstrated by isotopic data in Southern Euramerica (Bruckschen & Veizer 1997) allowing alternation of glacial versus very warm climates in Western Gondwana.

In Western Gondwana (Fig. 2), cold and dry climates with rather poor vegetation (Holocene Barren Grounds climate type) seem to alternate with less cold but wetter climates with glacier extensions and richer vegetation.

References


Streel, M., Traverse, A., 2006. Miospore stratigraphy, the tool to link Late Devonian continental macroflora, macroflora and events to the standard conodont zonation. GSA 2006 Philadelphia session 106 (abstract)


Legend of Fig. 1
Correlation of conodont and miospore stratigraphies
Relation between chronostratigraphy and conodont stratigraphy reproduced from Kaufmann 2006 (* in Conodont Zonation column for trachytera Zone)
The type Belgian lithostratigraphic data (Thorez et al. 2006) suggest that, in Kaufmann 2006, the Upermost marginifera conodont Zone (Um) duration is probably too long and the Middle expansa conodont Zone (unlabelled), probably too short, the last-one displaying 3 miospore Zones (VCo, VH, LL).

Legend of Fig. 2
Ages of miospore zones recorded in Western Gondwana
After Melo & Loboziak (2003).
The Uppermost Famennian quick changing climate

360.7 ± 2.7
Uppermost


Miospore correlation between eastern USA and western Europe

The Upper Famennian correlation challenge

The Lower-Middle Famennian vegetation crisis

Timescale and conodont zones duration after Kaufmann 2006

Fig. 1
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