

The Younger Dryas climatic event in the Cordillera de Talamanca, Costa Rica (extended abstract)

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Introduction

Costa Rican paleo-ecological evidence of the Younger Dryas climatic event was recently suggested by Hooghiemstra et al. (1992). Pollen records from cores of the La Chonta bog (9° 41'N, 83° 57'W) at ca 2310m elevation in the Cordillera de Talamanca permitted the reconstruction of changes in vegetation and climate of the last ca 80 000 years. This paper outlines a recently elaborated high-resolution pollen record showing the transition from Late Glacial to Holocene in detail. A distinct climatic cooling is now AMS-dated (on unidentified organic material) between $11\,070 \pm 130$ and 9800 ± 120 BP. It is followed by the well-defined transition to Holocene climatic conditions.

Description and discussion

To interpret Late Quaternary vegetational dynamics in the Cordillera de Talamanca, knowledge of the altitudinal distribution of present climate and vegetation is necessary. The La Chonta bog is situated nowadays in a humid to very humid, cool to cold climate with a short dry season of ca 4 months from December to April. Average annual temperatures of the upper montane and subalpine rain forest belts vary from 9 to 15 °C. In the 'paramo' zone mean annual temperatures vary from 9 to 11 °C and average annual precipitations from 1800 to 4000mm (Hooghiemstra et al. 1992).

The actual vegetation distribution in the Cordillera de Talamanca was described by Kappelle (1991), who outlined four major vegetation belts:

1) paramo (neotropical humid alpine vegetation) from ca 3300 to 3800m, an open type of vegetation, dominated by dense clumps of the bamboo *Chusquea subtessellata*.

2) subalpine vegetation from ca 3000 to 3500m, characterized by the shrub genera *Diplostephium*, *Drimys*, *Gaiadendron*, *Garrya*, *Hesperomesles*, *Holodiscus*, *Hypericum*, *Ilex*, *Myrica*, *Myrsine* and *Weinmannia*, and by Ericales, with an understory dominated by *Chusquea* and ferns (Islebe & Kappelle 1994).

3) upper montane rain forest from 2400 to 3300m, dominated by *Quercus costaricensis*, *Q. seemannii* and *Q. copeyensis*, and by the only alder species in this area, *Alnus acuminata*.

4) lower montane rain forest from 1500 to 2400m, with characteristic taxa such as *Alchornea*, *Alfaroa*, *Billia*, *Beilschmiedia*, *Clusia*, *Croton* and *Quercus*.

In the La Chonta bog area four local azonal vegetation types are recognized. They form a gradual transition from zonal lower montane forest towards aquatic vegetation in open lakes (Hooghiemstra et al. 1992).

The objectives of the present study are to estimate the descent of the upper forest line during the Younger Dryas climatic event, to assess the temperature rebound and to determine whether it was an effect of temperature, indeed, or of humidity, or both.

Figure 1 shows the correlation between the pollen records La Chonta-1 and La Chonta-2. Pollen zone 5 (440–430cm) of core La Chonta-1 shows a clear lowering of the upper forest line. This results in an extension at 2310m of the subalpine rain forest and indicates lower prevailing temperatures. This cooling event occurred just before the transition from the Late Glacial to the Holocene and was dated between $11\,070 \pm 130$ BP (440cm) and 10 400 BP (430cm, interpolated age).

The transition from pollen zone 5 to pollen zone 6 at 430 cm depth shows distinct changes. Percentages of *Quercus* again increase and values of Gramineae

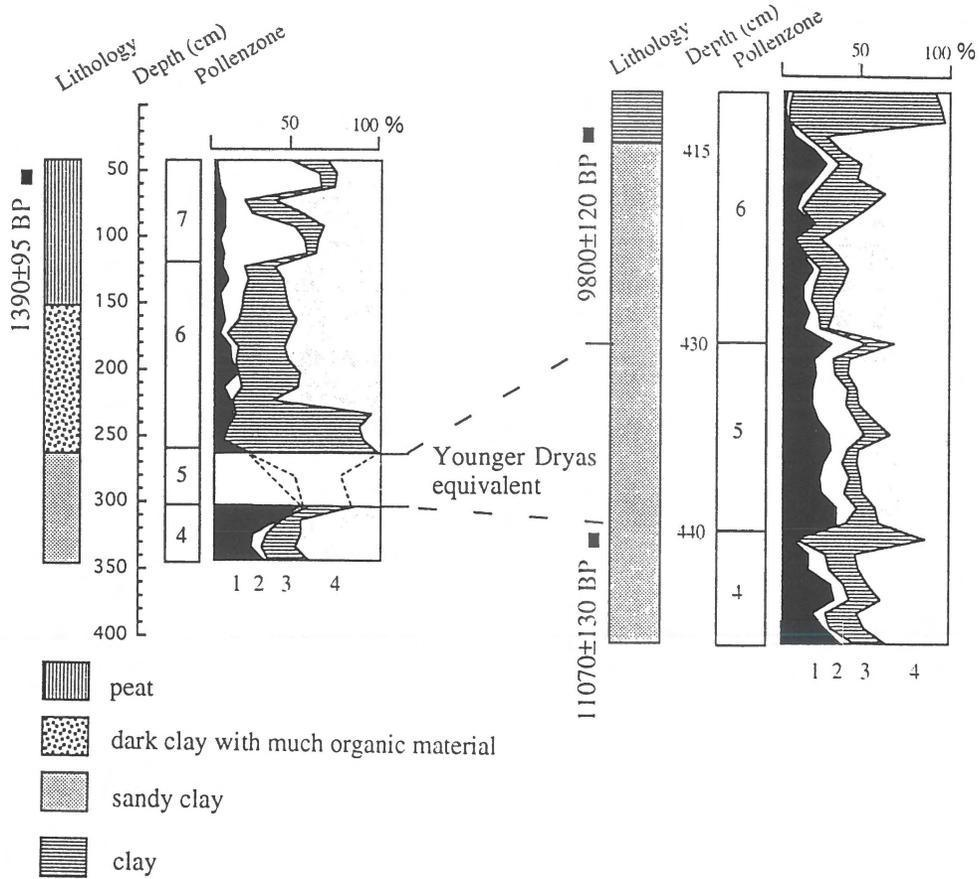


Fig. 1. Cumulative pollen percentage diagrams with main vegetation zones 1–4 of cores La Chonta-2 (2310 m, Hooghiemstra et al. 1992, left column) and La Chonta-1 (2310 m, this study, right column). The indicated main vegetation zones are groups of pollen which represent from left to right increasingly warmer climatic conditions. The Younger Dryas is characterized by a relatively high percentage of paramo and subalpine rain forest. 1 = paramo, 2 = subalpine rain forest, 3 = upper montane rain forest, 4 = oak.

decrease, marking an upslope migration of the oak forest belt. Percentages of *Isoetes* increase considerably in pollen zone 6. The upward shift of the oak forest belt is supported by the peak of the Cyatheaceae record, representing tree ferns which appear in secondary humid oak forest. Taxa indicative of subalpine conditions are the monoete fernspores, at present only found with high percentages at altitudes between 3000 and 3200m. Lower representation of *Isoetes* in the record indicates probably more humid conditions at the beginning of the Younger Dryas interval. In Colombian paleo-ecological studies the rise in *Isoetes* is related to higher lake levels (e.g. Hooghiemstra 1984). Studies by Horn (1993) in the Costa Rican paramos show that this assumption does not necessarily hold here. *Isoetes storkii* (the only *Isoetes* species in the area) is found in deep permanent lakes, but can also grow in shallow ponds, bogs and wet meadows. Therefore in our study

area higher percentages of *Isoetes* are probably related to a lowering of the lake level, permitting abundant presence of *Isoetes* on lake shores and shallow littoral zones. Estimation of the lake level position is hampered by the fact that no other aquatic taxa were found. The transition to Holocene conditions is indicated by an increase in *Podocarpus*, *Urticales* and *Ulmus* pollen grains and a strong increase of *Alnus*, indicative of the development of local alder carr.

Conclusions

During the Younger Dryas Stadial a lowering of montane vegetation zones occurred, leading to an extension of the paramo and the subalpine rain forest belt. Palynological results indicate an episode with a downslope shift of about 400–500m of the vegetation belts in Costa

Rica, and with an age that corresponds to the chronostratigraphic position of the European Younger Dryas oscillation. The upper forest line lowered during this cooling event to about 2100–2200 m. An estimated temperature drop of 2–3 °C is inferred, which corresponds to an estimated drop of 3 °C in Colombia (e.g. Hooghiemstra & Van der Hammen 1993). During the Younger Dryas cooling, paramo was clearly present in the La Chonta bog area. Open subalpine dwarf forest was close to the site. The transition to Holocene conditions is characterized by the development of *Alnus* swamp forest, which was subsequently replaced by upper montane rainforest, with oak as a dominant tree.

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