D/H in beetle chitin from the late-glacial Lismore site in eastern Canada: supplementary note

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D/H (Deuterium-Hydrogen) analysis of chitin from a late-glacial site in eastern Canada demonstrates promising results and lends support to other evidence for the Killarney Oscillation.

L'analyse du rapport D/H (Dentérium-Hydrogène) de chitine provenant d'un site tardi-glaciaire dans l'Est du Canada démontre des résultats prometteurs et vient appuyer d'autres données pour l'oscillation de Killarney.

[Traduit par la rédaction]

INTRODUCTION

Studies of stable isotope ratios in Quaternary beetle chitin were developed in the hope of providing a paleoclimatic tool to supplement taxonomic-based paleoclimate studies (Miller *et al.*, 1988). Recent publications have presented new data in relation to development of improved methods for chitin D/H (Deuterium-Hydrogen) analysis (Miller *et al.*, 1993; Schimmelmann *et al.*, 1993). Little has been said about the interpretation of these results since the data were collected to test the feasibility of analyzing small chitin samples, not for a high resolution analysis of late-glacial climatic events. However, recent work recognizing the Killarney Oscillation, a pre-Younger Dryas cold event seen in high resolution analysis of organic, pollen and chironomid content in lake sediments from eastern Canada (Levesque *et al.*, 1993), has made it appropriate to comment on initial D/H analyses of beetle chitin from a previously described late-glacial site near Lismore, Nova Scotia (Miller and Morgan, 1991). The Killarney Oscillation is described as a short but intense cold period that lasted from 11,160 to 10,910 years B.P. Its importance lies in its correlation with other short term events across the North Atlantic leading Levesque *et al.* (1993) to conclude a single event affected the entire region. Coleoptera fossils were recovered from a buried peat at Lismore dating from 11,900 to 10,500 years B.P. (Miller and Morgan, 1991). Climate interpretations based on the beetle assemblage suggested a gradual warming from 11,900 to the onset of the Younger Dryas around 10,600 years B.P. Colder "sub-arctic" conditions sometime prior to 10,600 years B.P. are indicated by the presence of the ground beetle *Elaphrus lapponicus*.

D/H RESULTS AND CONCLUSIONS

The D/H data combined with a revised stratigraphy of the Lismore site based on further field work in 1992 suggest a pre-Younger Dryas cold event that may be the Killarney Oscillation. The sample interval of 5 cm, typically used for beetle analysis and the need to process large samples to recover enough chitin for isotopic analysis, make the resolution much less than that used to initially identify the Killarney Oscillation. However, the D/H data demonstrate a negative peak in D/H around 11,250 ± 130 years B.P. (Fig. 1) based on extrapolation of the radiocarbon chronology over the sample interval. *Elaphrus lapponicus* has now also been identified from this interval. Furthermore, the late-glacial changes in summer surface water temperature based on chironomid analysis (Levesque *et al.*, 1993) from a high of about 19°C prior to the Killarney Oscillation, to a low of 15°C, and up to 17°C at the termination of the Killarney Oscillation is very similar, both in absolute numbers and in magnitude, to the calculated average "summer" temperature suggested by D/H in beetle chitin of 18°C, to a low of 14°C, recovering to about 17°C before the beginning of the Younger Dryas (Fig. 1). The methods for temperature determination are presented elsewhere (Miller *et al.*, 1988; Schimmelmann *et al.*, 1993). Routine D/H analysis of beetle chitin may be a long way off and the resolution of such studies need to be much better, but these results are encouraging for the future of the technique.

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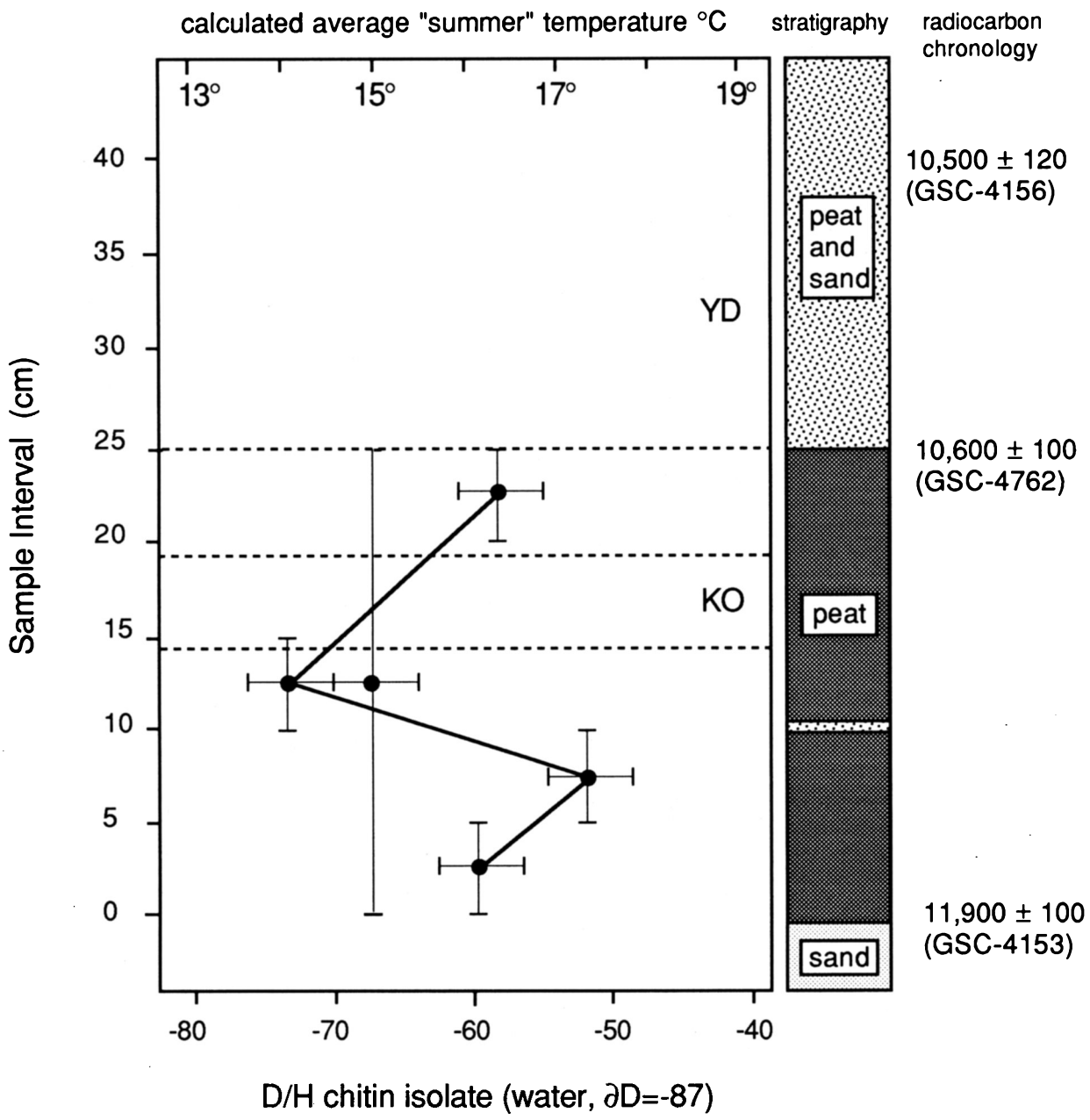

Fig. 1. D/H analysis of late-glacial chitin from Lismore, Nova Scotia, using techniques discussed by Schimmelmann *et al.* (1993). D/H ratios of chitin after isotopic equilibration with water vapour of ∂D = -87 per mil at 134°C over 20 hours, error of ± 3 ‰ based on modern chitin analysis. Calculated "summer" temperatures based on studies of modern beetles, ∂D chitin = -171.5 + 6.82 x (T°C > 0). Dating of sample intervals between 0 and 25 cm based on extrapolation of radiocarbon chronology (KO = Killarney Oscillation, YD = Younger Dryas). Diagram revised from earlier published versions based on new field work.