

## Reply to a comment by Dirszowsky, R.W., Mahaney, W.C., Kalm, V., and Beukens, R. on ‘A Middle Wisconsin interstadial in the northern Andes’ (Rull, V., 2005. JSAES 19, 173–179)

Valentí Rull \*

*Department of Animal Biology, Plant Biology and Ecology, Autonomous University of Barcelona, 08193 Bellaterra, Barcelona, Spain*

Received 1 November 2005; accepted 1 December 2005

In a recent article for the *Journal of South American Earth Sciences*, I proposed the existence of the El Pedregal Interstadial in the northern Andes, as recorded by a palynological analysis of a peat layer (VII) within a sedimentary sequence (PED5) from El Pedregal site (Rull, 2005). Dirszowsky et al. (this issue), using several arguments dealing with stratigraphy and terminology, claim that my data are not suitable to propose such interstadial. In this reply, I briefly address these issues to support and reinforce my former interpretation. Literal citations from the comment by Dirszowsky et al. appear in between quotation marks. The point that Dirszowsky and colleagues make is that peat VII, though it clearly records a warming event, does not represent an entire interstadial but only part of it, probably the onset. According to them, this 27 cm thick peat layer accounts only for few a thousand years, insufficient to be considered an interstadial. They propose that the real interstadial is represented by the entire PED5 section, a 8 m lacustrine sequence that contains seven peat layers (I–VII) representing short warmings (see Dirszowsky et al.’s Fig. 2). Thus, the interstadial, as proposed by these authors, lasted about 30 ka ‘from approximately 60 ka to just prior to the LGM’.

The difference between my interpretation and that of Dirszowsky and colleagues seems to rely on the concept of an interstadial itself. In my previous article, I used the current terminology from modern Quaternary literature, according to which ‘stadials’ and ‘interstadials’ refer to short cold and warm events, respectively, typically of one or few millennia duration, interspersed within glacials and interglacials (Bradley, 1999; Cronin, 1999; Roberts, 1998). Classical examples are, among others, the Younger Dryas stadial (~1500 year duration) and

the Allerød interstadial (~2000 year duration), which occurred during the last deglaciation. During the last glaciation, several interstadials of the order of one to a few thousand years have been defined in the oxygen isotope records of ice cores (e.g. GRIP, GISP). They are known as Dansgaard–Oeschger (D–O) events and named for interstadials (IS) 1–24 (Dansgaard et al., 1993). The time interval represented by peat VII is a few thousand years (2000–4000 years, according to Dirszowsky et al.). Dirszowsky et al. also agree with the climatic trend recorded in peat VII by pointing out that ‘the pollen sequence undoubtedly represents a cycle of warming and cooling...’. Thus, accepting the current chronostratigraphical and terminological frame, the event represented by the peat VII layer should be properly interpreted as an interstadial (Rull, 2005). As a consequence, the whole PED5 section should be considered a complex of interstadials, represented by peat layers I–VII, and not a ‘persistent interstadial’, as suggested by Dirszowsky et al.

In addition to these terminological differences, there are some inconsistencies in Dirszowsky et al.’s interpretation. They deny my interpretation of peat VII as representing an interstadial but simultaneously correlate it with a well-known interstadial event: ‘peat VII corresponds to a pronounced warm event (IS number 19 of Dansgaard et al., 1993)’. Furthermore, they affirm that ‘subsequent late stadial/early interstadial warm phases or ‘D–O’ events (sudden warming followed by gradual cooling) spanning periods of 1000–2000 years appear to coincide with the remaining peat layers’. This comment clearly supports the idea of an interstadial complex for PED5, instead of a long interstadial, as they have proposed previously. They even use the term ‘PED5 interstadial complex’. It is also noticeable that IS 19, considered by Dirszowsky et al. as the corresponding interstadial for the peat VII event, lies around 70 ka BP (Dansgaard et al., 1993), outside the age range proposed by these authors for their persistent El Pedregal Interstadial (~60–30 ka BP), in which around 10 interstadials have been identified (Dansgaard et al., 1993). These contradictions not only challenge their interpretation but reinforce my own (Rull, 2005).

DOI of original article: 10.1016/j.jsames.2006.03.002

\* Fax: +34 93 5811321.

E-mail address: valenti.rull@uab.es.

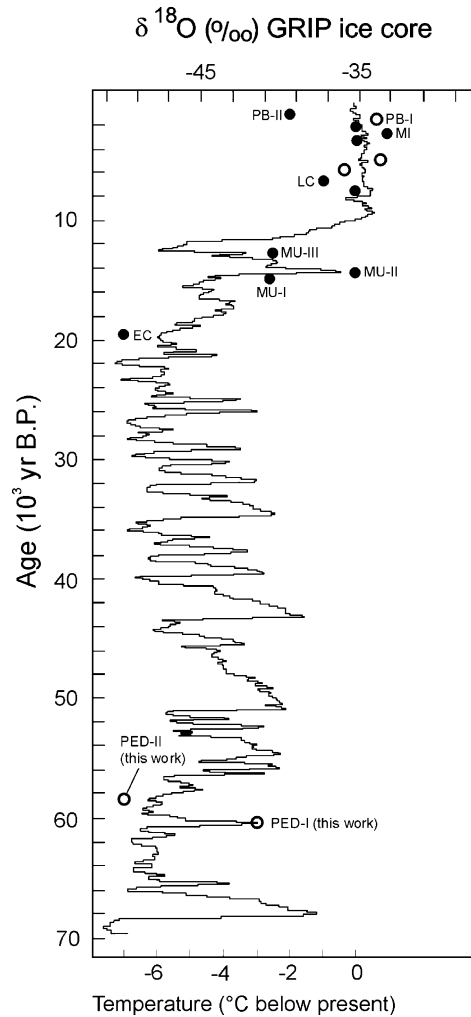


Fig. 1. Reproduction of Fig. 6 from Rull (2000) and Fig. 1 from Rull et al. (1999) showing the correlation of the paleoclimatic events recorded thus far in the Venezuelan Andes and the GRIP ice core. The El Pedregal Interstadial is indicated as PED-I, and the subsequent stadial as PED-II.

The chronology of the El Pedregal Interstadial, as defined by Rull (2005), is not yet firmly established. Initially, Rull (2000) and Rull et al. (1999) correlated it with interstadial IS 17, as defined in the GRIP ice core (~60–61 ka BP), on the basis of an initial finite age of  $58,350 \pm 2790$  for the top of the peat VII layer. However, Mahaney et al. (2001)—basically, the same authors as the Dirszowsky et al. team—assuming residual contamination by fulvic and humic acids, point out that ‘all VII dates should be interpreted as >60 ka and this peat layer was most likely deposited during the interstadial from 60 to 70 ka’ (note the use of the term ‘interstadial’ in the same sense of Rull et al. [1999] and Rull [2000, 2005] and in contrast to the proposition of Dirszowsky et al. in their comment). Therefore, the possibility of an older age was assumed and a tentative correlation with D–O events IS 17–19 suggested (Rull, 2005). In the absence of more precise dating, the actual age range for the interstadial represented by peat VII would be Early/Middle–Middle Wisconsin.

Dirszowsky et al. insinuate that they introduced the term El Pedregal Interstadial by considering it ‘a term used informally in several previous summaries of research and conference abstracts that were not cited in his article’ (referring to Rull, 2005). However, the El Pedregal Interstadial was provisionally described, named, and correlated with the GRIP record for the first time by Rull (2000) and Rull et al. (1999) (see Fig. 1). The only preceding reference given by Dirszowsky et al. to support their assertion is Mahaney et al. (1997), which I cited in my previous article, but for other reasons, as no any mention is made of the El Pedregal Interstadial. The other references correspond to posterior meeting abstracts, from 2001 onward. In one of them, specific mention is made in the title of a correlation with the GRIP isotopic record (Dirszowsky et al., 2004). These authors also mention another article accepted recently for publication in *JSAES*, in which the term ‘El Pedregal interstade’ is mentioned in the title; unfortunately, this work is not yet available. It is notable that both the name of the event and its correlation with the GRIP isotopic record appeared after 2004, shortly after I had sent a manuscript with all this information to *Boreas* and had been rejected, in which context one of the authors of Dirszowsky et al. acted as a referee. This manuscript was finally published in *JSAES* (Rull, 2005). I doubt if the content of the post-2004 papers by Dirszowsky et al. is the same, but the ideas undoubtedly are.<sup>1</sup>

As science is not a matter of someone being right and the others being wrong, but rather of finding the best interpretation of the real world given actual data, I would finish by proposing a solution to avoid confusion. One possibility is to call the whole assemblage of PED5 peat layers the El Pedregal Interstadial Complex, as done by Dirszowsky et al. in their comment, and to name each of the seven individual peat layers a Pedregal Interstadial, followed by numbers 1–7. In this way, the interstadial recorded palynologically in Rull (2005) would be the Pedregal Interstadial 1 (as the oldest of the complex), and so on. I offer this proposal for the consideration of interested researchers but remain open to other possibilities. I hope this reply fulfils the demand of Dirszowsky et al. to reinterpret the peat VII event in the proper stratigraphical context and contributes to a better understanding of the glacial chronostratigraphy of the Venezuelan Andes.

## References

- Bradley, R.S., 1999. Paleoclimatology. Reconstructing Climates of the Quaternary, second ed. Academic Press, San Diego, CA, p. 613.
- Cronin Th., M., 1999. Principles of Paleoclimatology. Columbia University Press, New York, p. 560.
- Dansgaard, W., Johnsen, S.J., Clausen, H.B., Dahl-Jensen, D., Gundestrup, N.S., Hammer, C.U., Hvidberg, C.S., Steffensen, J.P., Sveinbjörnsdottir, A.E.,

<sup>1</sup> The article by Dirszowski et al. about the ‘El Pedregal Interstade’ (*JSAES* 19 (2005), 525–536) appeared during the writing of this note. Interested readers can compare it with Rull (2005) and judge by themselves. Note the absence of any citations of my previously published papers about the subject, though at least one of the authors knew the details of my pollen analyses and paleoclimatological interpretation.

- Jouzel, J., Bond, G., 1993. Evidence for general instability of past climate from a 250-kyr ice-core record. *Nature* 364, 218–220.
- Dirszowsky, R.W., Mahaney, W.C., Milner, M.W., Kalm, V., Bezada, M., 2004. Late Quaternary lake level fluctuations and soil development in the Mérida Andes, northwestern Venezuela: correlation with the GRIP ice core. 32nd International Geological Congress, August 20–28, 2004, Florence, Italy, Abstract 79-18.
- Mahaney, W.C., Kalm, V., Bezada, M., 1997. Estratigrafía del Cuaternario Tardío en un ambiente proglacial en el área de Mucubají, Mucuchaché, El Pedregal. Andes centrales venezolanos. *Memorias del Congreso Latinoamericano de Sedimentología I*, 417–424.
- Mahaney, W.C., Russell, S.E., Milner, M.W., Kalm, V., Bezada, M., Hancock, R.G.V., Beukens, R.P., 2001. Paleopedology of Middle Wisconsin/Weichselian paleosols in the Mérida Andes, Venezuela. *Geoderma* 104, 215–237.
- Roberts, N., 1998. The Holocene. *An Environmental History*, second ed. Blackwell, Oxford, p. 316.
- Rull, V., 2000. Palynological record of a >60–58 ka B.P. (middle Würm/Wisconsin) warming in the northern Andes. *Proceedings of the XIII APLE Symposium*, pp. 351–364. (Available at <http://einstein.uab.es/vrull>)
- Rull, V., 2005. A Middle Wisconsin interstadial in the Northern Andes. *Journal of South American Earth Sciences* 19, 173–179.
- Rull, V., Bezada, M., Mahaney, W.M., 1999. The middle-Wisconsin ‘El Pedregal’ interstadial in the Venezuelan Andes: palynological record. *Current Research in the Pleistocene* 16, 111–113 (Available at <http://einstein.uab.es/vrull>).