

Interactive comment on ““EDML1”: a chronology for the EPICA deep ice core from Dronning Maud Land, Antarctica, over the last 150 000 years” by U. Ruth et al.

U. Ruth et al.

Received and published: 11 June 2007

Anonymous Referee 2 Received and published: 7 May 2007

Authors' response (bold face)

This paper describes the development of a chronology for the DML ice core. The Dome C chronology (which is based on a 1D ice flow model) is used as the basis of the new chronology, with stratigraphy (primarily volcanic fallout events over the past 128 ka) used to tie the two, i.e. to determine the age scale. Back to 41 ka BP, a link to the Greenland ice core chronology is also made through ^{10}Be and methane. Beyond 150 ka BP, the fit is ambiguous, possibly, it is suggested, due to the unknown rate of basal melting caused by elevated geothermal heat flux.

An understanding of the chronology of the DML ice core is critical to the interpretation of the core for climate studies. New data are presented and analyzed in a novel way, clearly explained and scientifically valid. The results support the conclusions, in my opinion with one small exception - there is very little evidence provided to support the assertion in the conclusions (but not mentioned elsewhere in the text) that geothermal heat flux variations may be responsible for the basal melt. The description of the work, reference to other appropriate material, presentation, supplementary material, etc. are all satisfactory or better.

This important paper should be published.

Some specific comments as I read through the manuscript follow, that I ask the authors to consider.

Page 540

Title should be changed to read “..over the past 150 000 years”. It is somewhat pessimistic to suggest that the past 150 000 years were in fact the last 150 000 years.

The use of "last" meaning "occurring next before the present;most recent" is a correct English usage (in the Oxford English dictionary); so the change is unnecessary.

Page 550

Abstract

line 10: here and throughout the text, it seems to me that if the word ‘age’ is used, then ‘BP’ should not be used. The word ‘age’ implies BP. So “For ages younger than 41 ka ..” or “At times less than 41 ka BP ..”.

Generally we state ‘BP’ to emphasise the use of AD 1950 as reference of the time scale (consistent with radiocarbon age scales) - to differentiate from e.g. b2k (before AD 2000) or ‘before year of drilling’. So when stating

‘BP’ in context with ‘age’ this only means that reference is not ‘today’ but AD 1950. However, ‘BP’ has been removed in context with duration throughout the text.

line 10: before ‘EDML1/EDC3’ (which does not need to be in italics), add “The new synchronized time scale,”

done

line 11: before ‘GICC05’ add “ice core chronology,”

done

line 13: I hope it is not the last 60 ka, but rather, the past 60 ka.

see above

line 16: “hint at a complex”

done

line 17: Given that geothermal heat flux is not mentioned throughout the paper until the last paragraph of the conclusions (see later), I don’t think it warrants a mention in the abstract. It is not a critical finding of this paper.

deleted from abstract

Introduction

first 4 lines: a couple of references as examples would be good, to interpretation, to cyclicity, and to phasing at different sites.

done

line 24: I would have thought point 1 might be (i) identification of different annual layer indicators

This is a tricky one: Identification of the indicator is only the first step;

also the layer itself must be identified (of course based on an indicator).

Page 551

line 7: change “would be” to “is”

done

line 11: “far reaching” in which sense? Back in time ?

corrected

line 17-18: the Parrenin paper is in this volume. Is this the special issue referred to on the next line?

yes. (to be handled during copy-editing)

Line 24: “counting leads to ... counting errors.” - re-word.

deleted

Page 552

line 1: I found the tense used several times in (throughout) the paper, somewhat difficult. Sometimes the past tense is used (e.g. “was”), sometimes the past participle is used (e.g. “has been”). Often in my opinion, the present tense is better. Here is an example “For the Holocene section it is therefore preferable to transfer the well-established ...” This would always be the case; not just when the authors did it. I will not comment further on this, but I do think the authors should consider this - it affects the readability of the paper.

We attempt to use present tense to describe something that always true and past tense to describe what we did. The case here is marginal. “was” has been changed to “seems”. Most occurrences of past principle have been deleted throughout the manuscript.

The argument from line 6 to line 26: The 1D EDC flow model is used for dating the

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EDML ice core. This is done because the complexity of the 3D model for EDML renders it impractical. However, it is stated earlier in the paragraph that for EDML, a 1D ice flow model CANNOT be employed to find a REALISTIC chronology, and that a 3D model is NECESSARY. While I suspect the logic of the science here is OK, (you use the EDC model as a substitute - as a proxy), I think some of the adjectives may need softening, e.g. “cannot” to “is best not”, “necessary” to “desirable”.

Here may be a misunderstanding: We used the results of the 1D EDC flow model (run at EDC!) by transferring it stratigraphically to EDML. The mistakable sentence has been removed.

line 6: “very gently slope”. You mean the slope is low. A slope cannot be gentle, just as a temperature cannot be colder, and an elevation cannot be higher. Can you provide an actual value for the slope?

We use ‘slope’ to denote a topographic feature, not the gradient. Value has been provided.

line 10: “.. upstream of the drill site at higher elevation ..” - of course !

Yes. Wording chosen for emphasis.

line 15-16: change to “... at present the surface is 240 m higher than at EDML and based on ...” i.e. delete “elevation: and add “than at EDML”.

done

Page 553

line 2: How were the selected dating constraints from EDML transferred to EDC

by using the stratigraphic link (has been clarified in text).

line 7: you see that you define dates (not ages) as a BP.

see above.

2. EDML-EDC stratigraphic link

line 11: so the EDML1/EDC date is 128.3 ka BP (or its age is 128.3 ka).

corrected

line 23: 73 cm would seem to me quite a large off-set.

but it's true.

Page 554

line 16: brackets around Clausen et al., 1997

to be checked again during copy editing

line 19: brackets around Traversi et al., 1997

to be checked again during copy editing

Page 555

line 14-15: replace “others but also these provide” with “others but they do also provide”

done

line 19: delete “a”, i.e. “There was great ...”

done

line 29: brackets around 2007 only, not around Severi

to be checked again during copy editing

Page 556

line 14: replace “too young ages” with “ages too young”

done

line 27: after “ambiguous beyond” add “this level”.

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done

Constructing the Chronology

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line 3: 779+/-5 a BP (insert “a”)

done

line 7. Can you provide a reference for a global signal from changes in production rate of ^{10}Be and ^{14}C ?

done

line 25: change “ follow closely” to “closely follow” Page 559

done

line 19: “Parrenin et al. (2007)”

to be checked again during copy editing

line 24: delete one of the “rapidly”s.

done

line 24 annual layer thickness unit is mm, not mm/a (see next line).

corrected

Page 560

line 3: the time-resolution of the data is better at EDML ...

corrected

line 10: fix brackets on Parrenin reference.

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5 Conclusions

line 24: 150 ka - I do not know what the preferred units are for 'Climate of the Past' , but I am sure that the preference will be for consistency.

done

Page 564

line 20-25: The "geothermal heat flux" argument is not mentioned anywhere above, and therefore should not be here, in the conclusions. If it is regarded as important to include it in this paper, it should be discussed above in a separate section. It seems to me however, that it is not critical to the content of this paper (what is important here is only that there is melt, for whatever reason), and therefore, that the "geothermal heat flux" argument can be deleted from here, and from the Abstract.

The geothermal heat flux argument has been deleted from the Abstract. The discussion has been shortened on p. 564.

Fig 4 Caption: line 2, change "after it was not taken as" to "after it was no longer taken as"

done

Fig. 5 caption:

Mathematically, a line is defined as straight. Therefore the marks on Figure 5 are not lines, they are curves.

We agree, but still prefer to use 'line' because the context here is graphical attributes where 'line' is more common than 'curves'.

Line 5: change to "Also marked, are the ..."

done

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We thank the reviewer for the precise and constructive review!

Interactive comment on Clim. Past Discuss., 3, 549, 2007.

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