We would like to thank Reviewer #2 Michael Hannah for his very constructive and helpful comments. In response to this we have taken the following actions:

Rev#2: After applying standard laboratory processing techniques, thirty specimens from each sample were analysed. I am not a statistician – but this number seems low. Can the authors demonstrate that this level of counting is statistically relevant?

Response: The Mann-Whitney U Test is applicable to all samples sizes and may be used with as few as four measurements in each sample (Fowler et al. 2009. Practical Statistics for Field Biology. 259 p.) A methodological "disadvantage" of this test it that it reacts very sensitive to small samples sizes and normally indicates no differences if the sample size tends to be low. The fact that in our experiment the Mann-Whitney U Test shows statistically significant differences, despite our low sample size, gives us even higher confidence in our results and indirectly demonstrates that our sample size was actually large enough.

Rev#2: Five species of terrestrial palynomorphs were focused on. Were these the only ones analysed? Also, there has been a major revision of the genus *Nothofagus*.

Response: Sentences have been updated to make clear only five common pollen and spore taxa were used for fluorescence analysis.

We are aware of the discussion started by Heenan & Smissen (2013) to split Nothofagus into four genera (Phytotaxa, 146 (1): 1–31). However, in order to be consistent with previous published palynological research at site U1356, Wilkes Land (e.g. Pross et al. 2012. Nature, 488, 73-77; Contreras e al. 2013. Rev Palaeobot Palyn., 197, 119-142) we prefer to keep the "old" genus name when describing the fossil record (see also discussion in Hill et al. 2015 Australian Systematic Botany, 28, 190–193).

Rev#2: One of the concerns I have involves the determination of in situ material prior to fluorescence analysis and its implications. As I understand the method, it is assumed that all of the specimens examined are in situ. Reworked material was identified and rejected based on a visual examination of each specimen. Of course, this is the only approach that can be used – but I think that the text should spell out clearly the limitations that this brings to the study.

Response: We do not assume that all of the specimen examined are "in situ". We added text and photos to Fig. 3 in order to better explain the "pre-selection process". We also added a new section 2 and additional paragraphs to the Discussion section where we provide a more detailed explanation of our approach and its limitations.

Rev#2: *I have to admit, however, that I am at a loss to understand figure 3. It needs a fuller, more detailed, caption explaining exactly what was the diagram is showing – as it stands I can't make the link between the diagram and the results outlined in the text.*

Response: The Figure 3 caption has been updated with additional explanation.

Rev#2: *My uneasiness with the assumption that all the specimens measured are in situ as outlined above is addressed to a degree in the discussion. But the argument appears to be somewhat circular. Analysis suggests that a shift to red indicates age and probable reworking,*

an in line 247 the authors state that the mean red fluorescence indicates that a "considerable proportion of the specimens are in situ." But how do we know that the rest aren't also in situ and the technique has failed? The authors seem to suggest that the answer lies in looking at the total assemblage and deciding whether or not sufficient numbers of individuals are in situ to trust the palynological analysis. But I'm not convinced that this gets around the circularity of the argument.

Response: The fluorescence signal of the "rest" of the specimen overlap with those from previous samples and therefore indicate that the sporomorphs have been reworked into the younger layers. A considerable portion of non-reworked sporomorphs is required to produce a signal which is significantly different from the previous. The principle of our approach is not fundamentally different from previous methods using autofluorescence in Palynology. We just propose using digital imaging (to measure the signal) and statistical analysis to make this process reproducible and independent from subjective classification of the analyst. We hope to have clarified our approach by adding a new section (Sect 2) to better explain the conceptual model and underlying assumptions.

Rev#2: But I would like to have seen a short section outlining how this approach may be applied in a practical sense.

Response: The practical applications have been addressed in the newly added concluding remarks (7) and section 2, where we explain the conceptual model and underlying assumptions.