

Interactive comment on “Paleomagnetic constraints on the timing and distribution of Cenozoic rotations in Central and Eastern Anatolia” by Derya Gürer et al.

Anonymous Referee #1

Received and published: 1 August 2017

The manuscript "Paleomagnetic constraints on the timing and distribution of Cenozoic rotations in Central and Eastern Anatolia" by Gülçrur et al. reports a large number of new paleomagnetic data from two sedimentary basins from Turkey with the aim to reconstruct the tectonic evolution of this complex sector of the circum Mediterranean area.

The manuscript is interesting mainly because it contains a new and large paleomagnetic dataset which could help to understand the rotational history of the different blocks which form this part of Anatolia.

However, in the present form the manuscript is not easy to read and the data pre-

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sentation is not clean at all, leaving a deep uncertainty in the possible use of these paleomagnetic data for tectonic interpretation

For all these reasons I recommend to deeply revise the manuscript before to resubmit it for another review procedure.

In particular the following points have to be fixed in the analyses of paleomagnetic data before to discuss their tectonic interpretation.

1) The first point concerns the way the authors calculate the ChRM component. This is a fundamental point for determining paleomagnetic rotations. a) In most of the orthogonal diagrams reported in Fig. 5 the ChRM component is forced to pass through the origin. This has been made even when the isolated component doesn't show a progressive decay toward it. In Fig. 5 this is the case of Alihoca (Fig. 5e,f), AkkÄššlğla (Fig. 5bb), Divrigi (Fig. 5dd), GuĬluĬln (Fig. 5ee), ArdÄšclğĬÄš (Fig. 5i), Bekclğili (Fig. 5l), Sincan (Fig. 5ii), Eminlik (Fig. 5o), Halkapinar (Fig. 5r), Zara (Fig. 5ll,mm), Hasangazi (Fig. 5t), Postalli (Fig. 5u), Topraktepe (Fig. 5x). In some other cases (e.g. Fig. 5d) the ChRM has been selected in a more correct way and doesn't pass to the origin. It is very hard to understand why the Authors have chosen to force or not to the origin the PCA for the different samples. In case a criteria exists it has to be described in the text, otherwise I recommend to not force the PCA to the origin and to recalculate it for all the samples where it has been made. This point is fundamental and has to be fixed in case of resubmission. b) Among the different criteria used for paleomagnetic data analyses the Authors have to consider also the MAD values obtained for each ChRM and use a selection criteria accordingly ($MAD < 10^\circ$). In some cases (e.g. Fig. 5b, 5bb among many others) the orthogonal diagram suggest that the MAD for the selected ChRM is very high. Please check all the data accordingly and discard those with high MAD c) in most of the cases there is no correspondence among the AF or TH demagnetization reported to have been used for calculating ChRM in the text and in Figures. In the ArdÄšclğĬÄš locality in the text it is reported " In most cases, linear decay towards the origin occurred at temperatures up to $\sim 320^\circ\text{C}$ " whereas in Fig. 5i

the last thermal step is 420° C. This discrepancy is very very frequent in the text and has to be fixed. 2) Calculation of the mean direction for each locality. I disagree with the statistical procedure used to calculate the locality mean direction. My opinion (not negotiable) is that the locality mean has to be calculated using the mean direction for each site and not using all together the single directions obtained from the different sites. The latter method increases the "quality" of the statistical parameter Alfa 95 but overweights the role of sites with a large number of samples. In theory using the method proposed by the authors I could have a single site with 100 samples showing a CCW rotation which has the same weight of nine sites distributed in the basin, each one with 10 samples and with very good statistical parameters, showing CW rotation. If a site has good, reliable, acceptable, statistical parameters (low alpha 95 and high k) it must have the same statistical weight of one site with a larger number of samples. 3) Mean direction in geographic or tectonic coordinates? The criteria used to distinguish sites with a post folding remagnetization is not clear at all. In the ArdÅsclglÅs locality, such an example, the rotation is calculated using the results in geographic coordinates because "A95 (2.5) is lower than the A95min (3.4)" and because "the tilt-corrected inclination of $\sim 30^{\circ}$ is considerably lower than that for Eurasia in the Late Cretaceous-Paleogene ($\sim 50^{\circ}$), whereas the geographic inclination of $\sim 45^{\circ}$ is not". Since the first observation is true both for tectonic and geographic coordinates ("The two sites share the same bedding and a fold-test is thus not possible") it seems that the Authors prefer to use the geographic coordinates directions because of the low inclination value in tectonic coordinates. This criteria is not acceptable because it is well known that inclination in sediments can be shallow than the expected one due to inclination flattening. The erratic criteria in choosing geographic or tectonic coordinates directions has to be avoided and I strongly suggest to only refer to "classic" field test (Fold and reversal tests) to discriminate between post folding or primary ChRM. 4) Reference direction Rotations are always calculated respect to the north and not to the Eurasia Reference poles, even if in some cases the Authors refer to the Eurasia poles for the inclination " $\sim 30^{\circ}$ is considerably lower than that for Eurasia in the Late Cretaceous-Paleogene

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($\sim 50^\circ$). This is very confusing for the reader. It is true that Eurasia does not rotate too much during the Tertiary, but I think the Author have to use Eurasia reference pole unless they have a clear reason for not, that must be reported in the text.

I think that all these points have to be fixed before using the paleomagnetic dataset for tectonic interpretation. For this reason I have not reviewed and commented the tectonic interpretation and discussion reported in the manuscript.

Introduction and geological settings are very difficult (sometime impossible) to read. They are plenty of geographic and fault names which are not reported in the figures. Please check that all the names in the text will be present in the figures.

Add a figure with the stratigraphic columns of the two basins which allow to show that they have the same stratigraphic evolution.

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2017-66>, 2017.

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