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Interactive comment on "The location of lithospheric-scale transfer faults and their control on the Cu-Au deposits of New Guinea" *by* L. T. White et al.

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General Comments

The authors are grateful for the constructive reviews by Hugh Davies and Kevin Hill. We also appreciate that both reviewers recommended that the manuscript be published after making some minor amendments. As such, we have modified the original paper according to each of the reviewer's suggestions. Our responses to the reviewer's comments and suggestions are listed below.

Specific Comments

Reply to Referee Comment by Hugh Davies (HD)

HD - Comment 1: About transfer faults: Transfer faults are mentioned in the title of the paper but the content of the paper focuses on arc-normal linear structures. The linear structures are not necessarily transfer faults and many may have originated as extensional features in response to arc-normal contractional stress (for example see Fig.2). Probably it is better for the authors to use an all-embracing term such as arc-normal structures or arc-normal fractures.

Response: We agree with the reviewer. We have modified the title and most of the text to call these "arc-normal structures". There are a few occasions where we have retained the term "transfer fault" when referring to what others have stated in earlier work.

HD - Comment 2: About geological maps and recent literature: Two papers that present overviews of the geology of New Guinea were published in 2012 and could have been referenced by White et al. (see Baldwin et al., 2012; and Davies, 2012). These and the published geological maps of the island would have provided additional information and ideas. However, the fact that they were not used is not a serious issue. This paper stands alone as one that addresses deep crustal structure using primarily geophysical data. It will be a good desktop companion to the others.

Response: We are pleased that the paper stands alone, but have cited Davies (2012) as this provided updated age limits on a unit that we discuss in the revised paper. We will include the maps that were presented in these two papers in later studies of the region.

HD - Comment 3: The various mineral deposits are listed as Cu-Au. This is true of only some of them. Others are Au or Au-Ag.

Response: We have corrected this issue throughout the text in the revised manuscript.

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Reply to Referee Comment by Kevin Hill (KH)

KH – Comment 1: On page 1700, they proposed four different theories for the difference between the previous models and their new model, but declined to state which theory they preferred. They did, however, note that their NE-trending lineaments only coincide with ore bodies younger than 4.5 Ma and propose that there may be a genetic link, but that older bodies, such as the giant Porgera and Mount Kare deposits in PNG, require a different genetic model.

Response: We have added further discussion of these points in the modified manuscript.

KH - Comment 2: The significant omission in the study is the lack of consideration of geology and the relation of their work back to geologic maps. Of all the regional NE-trending lineaments in the PNG fold belt, the Porgera-Mount Kare lineament is the most obvious from geologic maps structural analysis (Corbett 1994, Hill et al 2002, Hill 1991). As Hill et al (2002) stated, from south to north, the regional lineament is defined by the SE limit of the 120 km long basement-cored Muller Anticline, the NW limit of the low-lying (1800m) and volcanic -filled Tari Basin, the NW limit of deformed basinal Mio-Pliocene strata in the high (3000m) Andabare Plateau, the SE limit of the 120 km long, low-medium grade Om metamorphic terrane, the NE limit of the Miocene Maramuni igneous province and a 50 km offset NE-SW offset of the ophiolite belt. Given that these geologic provinces are typically 50-200 km long it is likely that the belt across which they terminate is of a similar dimension and hence lithospheric in nature. Perhaps the question for the authors should be why did their analysis not detect one of the most significant geologic lineaments across the New Guinea orogenic belt, particularly the one along which some of the world's biggest ore bodies were emplaced.

Response: We have added additional text in the modified manuscript to discuss the geological evidence in support of the transfer faults and why we did not detect the lineament beneath the Porgera-Mount Kare deposits.

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KH - Comment 3: Regarding referencing, it is misleading to state that Hill (1991) proposed arc-normal transfers across New Guinea, which is 2000 km long. The paper focused on the structural geology of the 300 km long and 100 km wide Papuan Fold Belt from a hydrocarbon perspective, with no mention of Cu-Au deposits, which were never considered.

Response: We have added text in the revised manuscript to address this point.

KH – Comment 4: Hill (1991) proposed four NNE-trending lateral ramps across the fold belt that separated areas with fundamentally different structural styles, detachment depths, thermal maturities for hydrocarbons and terranes of different elevation. Please note that there has been some further support for these NNE-trending tear faults in the Papuan Fold Belt from surface geology, seismic and aeromagnetic data, e.g. Hill et al 2008 and 2010. Furthermore, on page 1700 lines 10-20, the authors misunderstood the relationship between the NE-trending 'transfer' faults across the orogen and the NW-trending faults parallel to the orogeny. Hill (1991) suggested that both fault orientations developed during extension in the Mesozoic as down-to-the-basin faults offset by transfer faults. Such a fault system is currently observed in the Timor Sea and along Australia's NW Shelf (e.g. Longley et al 2002 and Hill et al 2010). Both fault sets were considered to have been reactivated in the Late Miocene to Pliocene and controlled the development of anticlines in the Papuan Fold Belt.

Response: We thank the reviewer for clarifying this point. We now understand that this earlier work referred to "transfer zones" that develop between extensional faults of different polarity in sedimentary basins (as per Longley et al., 2002 and many other studies of extensional basins around the world). We have added further text in the revised manuscript to discuss this issue.

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Technical Corrections

HD-1: Davies (1990) did not invent the term Bosavi Lineament; this appeared subsequently in petroleum industry literature. This requires a change in the text on p. 1689 and in the caption of Fig. 2.

Response: We have modified the text accordingly.

HD-2: Also Ananadi in Fig. 2 caption is misspelled.

Response: We have modified this text.

HD-3: Also on p.1689 line 26 I think “east” should be “west”.

Response: The reviewer is correct. We have modified this text.

HD-4: Figure 5: The bearing from Mt Kare to Porgera is about 045o not 080o as shown. One or other mineral deposit is at wrong location.

Response: The reviewer is correct. Mt Kare was mispositioned too far to the north in our previous database/figure. We have corrected this issue in each figure and double-checked this against our existing interpretation, which is still valid after the deposit was placed in the correct position. We have also double-checked the location of the other deposits by cross-validating our mineral deposit location database with available aerial photography.

KH-1: Abstract – line 6-7: previous work was not presented or of low resolution – it is hoped that the diagrams in this paper will be available at a much bigger scale than currently presented. Few of the features discussed are visible on the figures shown which range from 1-10 cm across, for instance the Bosavi lineament in Figure 2.

Response: We have revised Figure 2 to show more detail. In general, we also hope that the figures are presented at much higher resolution than what was allowed by the journal in our original submission. We will ensure that the figures are of sufficient resolution in the final version/proof, or will ensure that larger scaled images can be

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downloaded as supplementary material.

KH-2: Abstract, first line should be ‘locations’ with an s as plural is used.

Response: This has been corrected.

KH-3: Abstract - Not all deposits are Cu-Au

Response: We have corrected this issue throughout the text in the revised manuscript.

KH-4: Abstract 5th line poorly worded, the fluids and gas are not deposited.

Response: We have reworded this text in the revised manuscript.

KH-5: Abstract, line 6 ’data’ is used as singular; line 10 data used as plural, line 15 data used as plural, Section 2 line 5 data used as plural but on line 6 used as singular, page 1692 line 2 data singular. The word ‘data’ should be used consistently throughout the paper. Data are plural and datum is singular.

Response: We have corrected this issue in the revised manuscript.

KH-6: Abstract line 9 parentheses unnecessary and ugly in abstract.

Response: The parentheses were removed in the revised manuscript.

KH-7: Line 25. Bosavi lineament was proposed by oil industry and recorded by Smith (1990).

Response: We have modified this text (this point was also raised by Reviewer 1).

KH-8: Line 25-26. “data not presented or resolution is too low” exactly the same error occurs in this paper where the figures are so small no details can be discerned.

Response: We also hope that the figures are presented at much higher resolution than what was allowed by the journal in our original submission. We will ensure that the figures are of sufficient resolution in the final version/proof, or will ensure that larger scaled images can be downloaded as supplementary material.

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KH-9: Page 1692 line 28, the Fugro study was sponsored by the World Bank and is publically available.

Response: We have modified this text in the revised manuscript.

KH-10: Page 1693 line 15 remove 'the'

Response: This has been corrected in the revised manuscript.

KH-11: Page 1702 line 2 course should be coarse.

Response: This has been corrected in the revised manuscript.

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Interactive comment on Solid Earth Discuss., 5, 1687, 2013.