

## ***Interactive comment on “Biostratigraphic evidence of dramatic Holocene uplift of Robinson Crusoe Island, Juan Fernández Ridge, SE Pacific Ocean” by P. Sepúlveda et al.***

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The manuscript by P. Sepúlveda, J.P. Le Roux, L.E. Lara, G. Orozco, and V. Astudillo on "Biostratigraphic Evidence of Dramatic Holocene uplift of Robinson Crusoe Island, Juan Fernández Ridge, SE Pacific Ocean" is timely, well-written and well-argued contribution to our knowledge on the still largely enigmatic origins of ocean island uplift. Ocean island volcanoes throughout the ocean's basins mostly subside due surface loading, plate ageing/cooling and hotspot swell decay. However, some island systems (e.g. Cape Verdes, Canary Islands) and other isolated islands within mostly-subsiding systems (e.g. Santa Maria in the Azores) deviate from this trend, showing evidence

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for uplift at some point or throughout their evolutionary history. The cause of such uplift is still a matter of debate, with far-field flexural response to surface loading, intrusions, hotspot swell growth and isostatic response to erosion/mass wasting as possible mechanisms. The present paper comes to provide another example - Robin Crusoe Island - of such uplifting islands and proposes/discusses an explanation for such uplift: post-collapse isostatic rebound. Although it does not present a novel concept, it does document another singular case important to test existing ideas - and a case with extreme uplift rates. I am happy to recommend the manuscript for publication but I believe the discussion of plausible uplift mechanisms needs to be improved. As such, I make some suggestions that might improve the discussion on the paper:

General comments:

1) The paper rules out flexural loading of islands at a suitable distance (causing a flexural bulge) as the cause for uplift. Instead suggests post-collapse/erosional isostatic rebound, which is a possible and plausible explanation for the uplift. However, the authors cannot rule out intrusions at the base of the edifice (without surface volcanism) as another possible cause for uplift, as it has been proposed for other archipelagos, e.g.

A. Klügel, T. Hansteen, and K. Galipp. Magma storage and underplating beneath Cumbre Vieja volcano, La Palma (Canary Islands). *Earth and Planetary Science Letters*, 236(1-2):211–226, 2005.

J. Madeira, J. Mata, C. Mourão, A. Brum da Silveira, S. Martins, R. Ramalho, and D. Hoffmann. Volcano-stratigraphic and structural evolution of Brava Island (Cape Verde) from  $^{40}\text{Ar}/^{39}\text{Ar}$ , U/Th and field constraints. *Journal of Volcanology and Geothermal Research*, 196(3-4):219–235, 2010.

R. S. Ramalho, G. Helffrich, M. Cosca, D. Vance, D. Hoffmann, and D. N. Schmidt. Episodic swell growth inferred from variable uplift of the Cape Verde hotspot islands. *Nature Geoscience*, 3(11):774–777, 2010.

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R. S. Ramalho, G. Helffrich, M. Cosca, D. Vance, D. Hoffmann, and D. N. Schmidt. Vertical movements of ocean island volcanoes: Insights from a stationary plate environment. *Marine Geology*, 275:84–95, 2010.

R. S. Ramalho, G. Helffrich, D. N. Schmidt, and D. Vance. Tracers of uplift and subsidence in the Cape Verde Archipelago. *Journal of the Geological Society*, 167(3):519–538, 2010.

As such, the paper would become richer if this possibility was discussed and eventually admitted/rejected. However, from the evidence provided/discussed in the paper, I don't think the authors can entirely rule out this mechanism.

2) A look at the surrounding bathymetry is important to independently test the uplift, since 70 m of uplift in the last ~8 ka would inevitably dislocate the insular shelf edge (formed approximately at -130 m during the Last Glacial Maximum) upwards by approximately the same amount of vertical displacement. The shelf edge should be at approximately -60 m, if uplift of 70 m occurred within the last 8 ka.

3) Iwo Jima has similar uplift rates, if not higher - however the source is quite different (inflation of a volcanic dome).

Technical/minor comments to the text:

1) Lines 19-22 - propose to complete the existing sentence to the following:

"As the plate moves away from the melting source due to sea-floor spreading, these volcanoes are extinguished and new volcanic edifices arise over the active hotspot, forming linear, age-progressive island chains such as the Hawaiian-Emperor seamount chain.

2) lines 26 - 4

"Uplift and subsidence, as earlier noted by Charles Darwin in the 19th century, mostly respond to the growth of the underlying swell and the related isostatic rebound."

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This sentence is too simplistic in its view - needs revision. In addition to hotspot swell growth and post-erosional isostatic rebound, uplift has also been explained by flexural bulge effects resulting from loading of nearby islands; changes of density in the mantle; and intrusions at the base of the edifice. Subsidence is mostly due to flexural loading and ageing/cooling of the lithosphere (processes unknown to Darwin in the early 19th Century).

3) page 13612, lines 21-22

"The dramatic Holocene uplift of RCI cannot be explained as a flexural response to the loading exerted by the active hotspot."

The hotspot does not exert surface loading - the edifices created at the hotspot do. The expression should thus be corrected. Also, unless new islands/seamounts were being created in the last 8000 years - which is not the case - this hypothesis was already very implausible.

4) same page, lines 26-27

"The bathymetry in fact seems to indicate relative subsidence of this part of the oceanic crust."

How can the authors know this? The lack of a bulge does not mean subsidence - just lack of uplift by inflation of the surrounding seafloor? Besides, the authors have no age constraints when looking at the bathymetry - and the reported uplift concerns the last 8 ka...

5) same page, lines 27-29

"General subsidence could occur in the wake of a mantle plume migrating away from a particular area, as this part of the crust would no longer be sustained by it, combined with the load (...)

The word "crust" should be substituted by "lithosphere". Dynamic uplift/subsidence is

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impinged at the base of the lithosphere, not the crust.

6) page 13613, lines 15-17

"The two islands might have been separated during a large-scale landslide event (or events), which in turn may have caused iso- static rebound."

Further evidence for this should be found using a bathymetric map with medium resolution, if available.

7) There are 2 references that are mentioned in the text but are not in the reference list:

Watts and Ten Brink (1989); Ramalho et al., (2010);

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