LMU • Mineralogie • Theresienstraße 41/III • 80333 München

Editorial board - Solid Earth / Copernicus,
Luisenstrasse 39
80333 Munich (Germany)

Topical editor:
Dr. Michael John Heap
5 rue René Descartes
67000 Strasbourg (France)

Dr. Guilhem Amin Douillet

Telefon +49-89-2180-4272
Telefax +49-89-21804176
g.douillet@min.uni-muenchen.de
http://www.lmu.de/mineralogie

Department für Geo-und
Umweltwissenschaften
Theresienstraße 41/III
80333 München
GERMANY

Ihr Zeichen, Ihre Nachricht vom Unser Zeichen

Quito, 07.04.2015

Response to discussion on the SED6_3261–3302 manuscript draft by Douillet et al. for Solid Earth.

Dear editor,

Please find below a response to the comments from reviewers of "Syn-eruptive, soft-sediment deformation of dilute pyroclastic density current deposits: triggers from granular shear, dynamic pore pressure, ballistic impacts and shock waves" by *G. A. Douillet et al.*

The comments were very useful and careful, so that most of them have been accepted, and thus no response was given. Only some points that were not modified as suggested are discussed here.

Comments from an anonymous reviewer:

This careful review was very useful and most comments have been accepted.

The discussion on flows' "accumulative vs. depletive evolution" was removed, since the "soft-state deformation" structures observed here do indeed not permit discussion without abusive speculation…

Specific comments:

"2,71 'metastable conditions' meaning what? Typically they are both unsteady and non-uniform, but be clear how this favours SSD. Do you mean rapidly changing capacity?":
-This relates tot he deposit state, not the flow, adapted.

"2,108 I like "potatoids" but suspect this is no more helpful than pseudonodule; irregular rounded bodies?":
-Given the comments from the other reviewer noting confusion on the term pseudonodule, the term potatoid was kept and pseudonodule removed.

"7,437 Water would enhance cohesion but the concept, as stated, of overweight due to water is too simplistic; needs some elaboration":
-Sentence modified into "This would enhance cohesion on one hand, and the overweight due to water acting on freshly emplaced, unstable beds could also have triggered the sliding."

"10,587 I suggest: . . .and may systematically relate to both flow unsteadiness and flow non-uniformity. Check the veracity of the following statement; on the ground it is the other way around for experimental debris flows at USGS flume. Clearly one would anticipate high dynamic pressure associated with the 'impact' of a flow front, but this may not be the same as 'felt' by deposit on the ground. This is worth exploring...":
-Experiments by Roche et al. 2010 cited, indeed flow fronts relate to an underpressure due to dilation.

"11,705 yes, and this needs reconciling with earlier account regarding dynamic pressure and pore pressure effects (see above)":
-A shock wave is not related to a granular flow… I do not understand the link with flow's dynamic pressure.

Comments from Massimo Moretti:

Comment A (Confusing abstract)
-Abstract was re-organized in order to keep a difference in listing of features, and their interpretation.

Comment B (Nomenclature)
-The main problem noted by this reviewer was on the nomenclature. After some private exchanges, the nomenclature was adapted. The term pseudonodule was removed. Potatoids, pipes, and dishes were introduced (Nomenclature, and through the text). We did want to respect the use of purely descriptive term before interpretation, so that we avoided the use of "load structures" "slumped beds" "water-escape structures", "dikes", etc... (Applies also for specific comments 4; 5; 8)

Comment C (Re-organization of Geological setting and data part)
- The part on geological settings (and consequently the order in interpretation was re-organized and title changed. We do understand the arguments from Moretti, but couldn't adapt as suggested (*"It is more simple and logic to separate SSDS using morphologies, mechanisms of deformation and/or sub-environments."*). SSD features are still presented by outcrops, but the order of appearance of each outcrop was changed, in order to have the interpretation following this order: 1. pipes/pore-pressure (Soufrière and Laacher See outcrop), 2. shearing structures (Tungurahua and Ubehebe), 3. slumps (Ubehebe), 4. impacts (Ubehebe and Laacher See), and 5. shock waves (Tower Hill and Purrumbete).

-Most suggested references were added. However, Allen et al. (1982) and Fisher and Schmincke (1984) were not included, since these are very general books on sedimentology or pyroclasts. The reinterpretation by McPherson et al. (1989) of Nocita et al. (1988) was inserted and highlighted, although the main conclusions should hold.

Specific comments:

"1) Page 3262, lines 1-5. I suggest to begin the abstract directly with the focus of the paper, deleting general sentences. Please start with "We document examples of syn- eruptive..."":
-The pyroclastic community is not necessarily familiar with SSD, so that the general introductory sentences were left. The focus of the paper is to attract attention on these structures in the pyroclastic context.

"2) Page 3264, line 10. SSDS are not rare in subaerial environments. Effects of liquefaction during present-day earthquakes are sand blows and dykes formed in continental settings."
-Modified

"3) Page 3264, line 11. Seismogenic fluidization and/or liquefaction. I suggest to use the term "seismically-induced liquefaction" here, since fluidization is often only a result of re-sedimentation after complete liquefaction (Allen, 1982)."
-OK

"4) Page 3264, from line 18 to the other page. See general comment A."
-Adapted and also thorough the text figures and tables.

"5) Page 3265, line 13. I suggest to delete "with some angularity"."
-OK

"6) Page 3267, line 14. Please pay attention citing the paper of Nocita (1988) for trig- gers related with primary volcanic origin (at page 3279 too). This paper was criticised by McPherson et al. (1989) who show how the deposits containing the SSDS are fluvial/alluvial in origin."
-Accounted for (reference and reinterpretation added, though the mechanism may still be valid)

"7) Page 3274, lines 1-4. Load-structures (load-casts, ball-and-pillows and flames) with asymmetrical features induced by high-rates of sedimentation and recording the slope orientation (maybe flow-direction too?) are described in Moretti et al. (1999) with calculations and analogue models."
-Was Moretti et al 1999 or Moretti et al. 2001 meant? We have added the 2001 citation here.

"8) Fig. 1.e. Pseudonodules seem to be load-casts. They are not detached from the overlying source bed. The term pseudonodule is used for completely "isolated" masses (without preserved lamination) of material coming from the upper unit. I do not understand the term dike used here."
-Adapted in the nomenclature and all along text, figure, and tables.

"9) Fig. 6 is unclear. I cannot distinguish any clear recumbent folds. I can see dis-torted/contorted laminations as in a slumped bed."
-Highlights were added and brackets for the pseudo-wavelength. Note, a slumped bed has a preferential direction, thus often with some recumbence?

Best regards,

Guilhem Amin Douillet, on behalf of all authors.

PS: Please accept all my apologies for the delayed answer. Intense field-work did not permit to work properly on the manuscript until recently.