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Peer Review File

Seismic events drive pollution in Japan Trench hadal basins

Corresponding Author: Dr Piero Bellanova

This file contains all editorial decision letters in order by version, followed by all author rebuttals in order by version.

Version 0:

Decision Letter:

<*** REMEMBER TO ATTACH REVISIONS CHECKLIST (WORD)***>

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Dear Dr Bellanova,

Your manuscript titled "Shaking Up Pollution – Seismic events drive pollution in the Japan Trench hadal basins" has now been seen by our reviewers, whose comments appear below. In light of their advice we are delighted to say that we are happy, in principle, to publish a suitably revised version in Communications Earth & Environment.

We therefore invite you to revise your paper one last time to address the remaining concerns of our reviewers. At the same time we ask that you edit your manuscript to comply with our format requirements and to maximise the accessibility and therefore the impact of your work.

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We hope to hear from you within two weeks; please let us know if you need more time.

Best regards,

Nandita Basu, PhD
Consulting Editor, Communications Earth & Environment
Associate Editor, Communications Sustainability
Nature Portfolio

REVIEWERS' COMMENTS:

Reviewer #1 (Remarks to the Author):

This paper describes the impact of large-scale events such as earthquakes on deep-sea sediments, including an important finding that the floor of the Japan Trench contains contaminants of terrestrial origin. Gravity currents and submarine landslides are hypothesized as the transport processes, and the subsequent influence of deep-sea currents is also mentioned. In this respect, the paper offers a deeper understanding of sedimentation processes in the Japan Trench.

Deep-sea currents have long been known to flow along the Japan Trench and the Kuril Trench, and their speeds are known to be strong enough to push back the Shinkai 6500. Deep-sea currents flow at a depth of approximately 6,000 meters, maintaining a balance between water masses. Surface sediments are blown away from the seafloor in this area, exposing Miocene sediments. It is well known that these currents eroded new sediments, leading to the discovery of "petit spots," small mounds formed by volcanic eruptions 6 Ma. Deep currents have been observed flowing from south to north on the outer rise, while on the landward slope, a countercurrent flows from north to south. The true nature of deep currents at the bottom of the Japan Trench remains unknown. However, images from deep-sea camera systems clearly suggest the presence of strong currents there. It's possible that these deep currents, or related currents, have reset and flattened the topographical irregularities, such as reverse faults, caused by earthquakes prior to 2011. Given this, it's easy to imagine that the influence of deep currents in the Japan Trench is significant and widespread, affecting every event deposit. However, the fact that their true nature remains unknown will pose a major obstacle to future attempts to unravel past earthquake and tsunami history from event deposits. Or perhaps we'll have to start all over again.

Curiously, sedimentation rates in the Japan Trench vary greatly depending on the region. While the mechanism is not fully understood, it's easy to imagine that sedimentation and erosion by deep currents plays a major role. Such regional differences in sedimentation rates are evident when looking at the Atlantic Ocean. From this perspective, it can be said that the influence of deep-layer currents around Japan has been underestimated. This is especially evident when compared with the Atlantic Ocean. We hope that this study will serve as a starting point for further studies into the influence of deep-layer currents on sedimentation around Japan.

Reviewer #2 (Remarks to the Author):

This manuscript is based on an interesting variety of scientific data obtained from one of the deepest trenches on Earth, which is not only fascinating because of the geological processes related to subduction, such as the occurrence of large-magnitude earthquakes triggering major landslides on the slope, but also because of its proximity to large centres of pollution and, even from historic nuclear explosion sites.
The manuscript is truly groundbreaking, as it indicates the presence of differentiated levels in very deep sea beds caused by sliding of human activity sediments. The description of these levels could be used to refer to the controversial new proposal geological epoch named as the Anthropocene, referring those geological period induced by the human activity. The accumulation of pollutants in one of the deepest oceanic areas in the world can serve as a reference for studying the evolution of the increase in pollutants. And not only of the pollutants from industrial emissions, but also nuclear waste that can serve as indicators of human activity. In this sense, this study could used as a reference geosite for marking the boundary of the Anthropocene. For all these reasons, I recommend the publication of this manuscript.

Response to Reviewers

We thank the Editor and the Reviewers for their careful evaluation of our manuscript and for their constructive and encouraging comments. We have addressed the editorial requirements in detail (see Editorial Requests Table) and respond to the reviewers' comments below.

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Deep-sea currents have long been known to flow along the Japan Trench and the Kuril Trench, and their speeds are known to be strong enough to push back the Shinkai 6500. Deep-sea currents flow at a depth of approximately 6,000 meters, maintaining a balance between water masses. Surface sediments are blown away from the seafloor in this area, exposing Miocene sediments. It is well known that these currents eroded new sediments, leading to the discovery of "petit spots," small mounds formed by volcanic eruptions 6 Ma. Deep currents have been observed flowing from south to north on the outer rise, while on the landward slope, a countercurrent flows from north to south. The true nature of deep currents at the bottom of the Japan Trench remains unknown. However, images from deep-sea camera systems clearly suggest the presence of strong currents there. It's possible that these deep currents, or related currents, have reset and flattened the topographical irregularities, such as reverse faults, caused by earthquakes prior to 2011. Given this, it's easy to imagine that the influence of deep currents in the Japan Trench is significant and widespread, affecting every event deposit. However, the fact that their true nature remains unknown will pose a major obstacle to future attempts to unravel past earthquake and tsunami history from event deposits. Or perhaps we'll have to start all over again.

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Authors response: We thank Reviewer #1 for the thoughtful comments regarding the role of deep currents in the Japan Trench and their potential influence on sediment redistribution and event deposits.

We agree that deep and bottom currents may play an important role in sediment erosion, redistribution, and preservation within the trench system. To acknowledge this important aspect, we have clarified in the revised manuscript that although earthquake-triggered gravity flows represent a primary mechanism for rapid contaminant transport, the interaction with deep currents and their potential reworking effects remain areas of uncertainty that warrant further investigation.

We also highlight that the complex hydrodynamic regime of the trench, including potential along-axis and slope-parallel currents, may influence preservation and regional variability in sedimentation rates. We

appreciate the Reviewer's perspective and agree that future work should further investigate the role of deep-layer circulation in shaping event deposits.

Reviewer #2 (Remarks to the Author):

This manuscript is based on an interesting variety of scientific data obtained from one of the deepest trenches on Earth, which is not only fascinating because of the geological processes related to subduction, such as the occurrence of large-magnitude earthquakes triggering major landslides on the slope, but also because of its proximity to large centres of pollution and, even from historic nuclear explosion sites.
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Authors response: We thank Reviewer #2 for the very positive evaluation of our manuscript and for emphasizing the broader implications of our findings, including their relevance to anthropogenic signatures in deep-marine environments.

We appreciate the recognition of the potential relevance of these deposits for understanding human influence in remote oceanic systems. In the revised manuscript, we have ensured that our discussion of anthropogenic signals is framed cautiously and avoids overstatement, while still highlighting the broader implications of contaminant accumulation in hadal environments.