

## Changes in marine sedimentation patterns in the northeastern South China Sea in the past 35000 years

Corresponding Author: Professor Shu-Kun Hsu

Version 0:

Decision Letter:

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Dear Professor Hsu,

Your manuscript titled "Dramatic change of the marine environment in NE South China Sea in the past 35000 years" has now been seen by 3 reviewers, whose comments are appended below. You will see that they find your work of some potential interest. However, they have raised quite substantial concerns that must be addressed. In light of these comments, we cannot accept the manuscript for publication, but would be interested in considering a revised version that fully addresses these serious concerns.

\*\*\*\*\*

In particular, please ensure that the revised manuscript meets the following editorial thresholds:

\*\* Provide firm and sufficient evidence that sea level variations and the erosion of the continental slope during the Last Glacial Maximum caused the formation of a regional unconformity in the northeastern South China Sea.

\*\* Clearly demonstrate that the deposits you discuss are contourites and not turbidites.

\*\* Provide supporting data based on a digital imaging technique (SEM-EPMA) to support the textural analysis of your data, and, and provide additional details on the radiocarbon data, including details of the age correction and the robustness of your plotting software.

\*\*\*\*\*

We hope you will find the reviewers' comments useful as you decide how to proceed. Should additional work allow you to address these criticisms, we would be happy to look at a substantially revised manuscript. If you choose to take up this option, please either highlight all changes in the manuscript text file, or provide a list of the changes to the manuscript with your responses to the reviewers.

Please bear in mind that we will be reluctant to approach the reviewers again in the absence of substantial revisions.

If the revision process takes significantly longer than three months, we will be happy to reconsider your paper at a later date, as long as nothing similar has been accepted for publication at Communications Earth & Environment or published elsewhere in the meantime.

We are committed to providing a fair and constructive peer-review process. Please do not hesitate to contact us if you wish to discuss the revision in more detail.

Please use the following link to submit your revised manuscript, point-by-point response to the reviewers' comments with a list of your changes to the manuscript text (which should be in a separate document to any cover letter), a tracked-changes version of the manuscript (as a PDF file) and any completed checklist:

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Please do not hesitate to contact us if you have any questions or would like to discuss the required revisions further. Thank you for the opportunity to review your work.

Best regards,

Carolina Ortiz Guerrero  
Associate Editor  
Communications Earth & Environment

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## REVIEWER COMMENTS:

Reviewer #1 (Remarks to the Author):

The authors presented a detailed investigation on the depositional environment in NE South China Sea in the past 35000 years. The LGM caused great changes of the global climate and the sea level. This is also the situation in China and its surrounding areas. We can see the erosional unconformity and distinct depositional periods across the boundary from the sub-bottom profiler data as shown in this work. Besides the SBP, a convinced sediment core analysis was carried out to favorer the sedimentary environment as the SBP indicates. In total, this work successfully depicts the 'dramatic change' of the marine environment in NE SCS throughout the LGM. As reported in global scale, this change has been regarded as an important factor in contributing to condition for both geological and biological evolution. Especially, the changes should have affected the sediment provenance, circulation, weather, and even carbon cycling. In this sense, I expect to see more influences on these factors and the possible link between "change" and them. As the authors claim in Line 54-56, the aim is to find factors that control the change and relationship with paleoclimate and paleoceanography. In my view, this aim should be strengthened by giving more evidence or discussions, although this work has achieved this goal in greater detail. One possible way is to compare the sediment provenance around the study region (maybe the NE SCS), the weather on land and sea. I also recommend the authors to look into the hominid migration of Taiwan under this 'dramatic change', if possible, and it should be very interesting. Some suggests can be found below.

- 1.What is the possible path for the risen sea water pouring into the SCS?
- 2.Evolution of the channels KC and PC could be provided. These two channels are very close to the study area, the influences from them should be taken care very carefully.
- 3.Line 95-96: what is the velocity of the sediment for calculating the depths.
- 4.Fig.3a provides a very clear plain map of the depth to the erosion unconformity. It seems that the west flank of the GWR deposited much more than the east one. Can the author explain this?

Reviewer #2 (Remarks to the Author):

Apologies for the delay in my response. I have carefully reviewed the manuscript by Chen et al., titled "Dramatic Change of the Marine Environment in NE South China Sea Over the Past 35,000 Years." The paper is well-composed, presenting a compelling narrative that I believe will be of interest to the readership of the journal Communications Earth & Environment. Here is some advice for the authors to consider:

1. The interpretation of contourite systems should be more reinforced. While the authors acknowledge the core site's distance from primary sediment pathways, its proximity to a network of densely distributed canyons or channels cannot be overlooked. Consequently, the possibility for these sediments to be formed by turbidity processes must be carefully evaluated. I recommend that the authors conduct a more detailed comparison of contourite versus turbidite depositional models to more convincingly rule out turbidite processes and support the contourite interpretation. What's more, the current interpretation of contourite facies relies too much on PSA results. Core data, including enlarged core photos, should be more involved in the analysis of depositional facies.

2. About the IWC. As far as I know, some previous studies on the IWC of the South China Sea seem much too subjective, relying too much on seismic data. Some key aspects of IWC, including its flow path, acting depths, and velocities, have not been fully revealed. I propose that the authors include a comprehensive, up-to-date synopsis of the IWC within the regional settings section of the paper. The use of ADCP data by the authors is great. However, the reported velocity of 17.4 cm/s appears high for deep-water bottom currents. Was it influenced by turbidity current? Could the authors elaborate on whether this velocity is consistent with findings from previous studies?

Haiteng Zhuo  
School of Marine Sciences, Sun Yat-sen University

Reviewer #3 (Remarks to the Author):

Title: Dramatic change of the marine environment in NE South China Sea in the past 35000 years

Author: Kuan-Ting Chen, Shu-Kun Hsu, Andrew Tien-Shun Lin, Chih-Chieh Su, Nathalie Babonneau, Gueorgui Ratzov, Serge Lallemand, Pi-Chun Huang, Lien-Kai Lin, Hsiao-Shan Lin, Ching-Hui Tsai, Jing-Yi Lin, Song-Chuen Chen  
Manuscript No.: COMMSENV-23-1939-T

#### Comments

- The present manuscript has attempted to delineate the regional uniformity along the continental slope of NE South China Sea. The study objective seems interesting however the major lacune is that the interpretation has been made on limited proxies and supporting evidence.

#### Other Comments

- The abstract seems to be starting abruptly without providing any background information and needs to be re-written.
  - The introduction doesn't provide any information about the aim of the present manuscript. It should be elaborated to bring out the significance of the present study and should be discussed well.
  - Section 3.2.2: provide appropriate references and citations regarding the procedure and protocols.
  - Section 3.2.3: Please provide relevant references for the regional reservoir age correction adopted in the present study and a modelled age-depth plot using appropriate software. Also, provide the median age for the respective ages.
  - Exchange section 4.2 with section 4.3 so that the discussion in section 4.2 should be w.r.t the age along with the depths. Maybe the age can be mentioned in brackets such as in line 166: '... From core depth 575 to 600 cm (\_\_\_\_ cal yr to \_\_\_\_ cal yr BP) ...'.
  - Here authors have made the majority of the discussion on textural analysis however, they should also try to do some SEM and/or EPMA of the grains to provide better understanding and interpretation.
  - The MS should also try to focus on the significance of the present study in global scenarios and not limit their interpretation in a local or regional scale.
  - Thus, I recommend REJECTING the MS, however, I would request authors not to be disheartened and try to support their interpretations and inferences on additional proxies and supporting evidence.
- Good Luck

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Author Rebuttal letter: The author's response to these comments can be found at the end of this file.

Version 1:

Decision Letter:

**\*\* Please ensure you delete the link to your author home page in this e-mail if you wish to forward it to your coauthors \*\***

Dear Professor Hsu,

Your manuscript titled "Dramatic change of the marine environment in NE South China Sea in the past 35000 years" 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 under the open access CC BY license (Creative Commons Attribution v4.0 International License).

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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Please review our specific editorial comments and requests regarding your manuscript in the attached "Editorial Requests Table".

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Please outline your response to each request in the right hand column. Please upload the completed table with your manuscript files as a Related Manuscript file.

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

Best regards,

Carolina Ortiz Guerrero, Ph.D.  
Associate Editor  
Communications Earth & Environment

#### REVIEWERS' COMMENTS:

Reviewer #1 (Remarks to the Author):

The revised manuscript has clarified the questions that I have proposed in review. As I suggested, it should be published as soon as possible. I have no further questions and concerns about the paper.

Reviewer #2 (Remarks to the Author):

The revised manuscript shows significant improvement and has addressed all my concerns. I agree to accept it.

Reviewer #3 (Remarks to the Author):

In the revised manuscript, now the authors have made significant changes and incorporated the suggestions made by the reviewers. In view of the above, I recommend ACCEPTANCE of the MS with some grammatical checks and corrections. As a suggestion, I would request the authors that in their future studies from the present study area, they should look into climate reconstruction and its implication in global climate variability. So that the climate dynamics of the Quaternary on a global scale from their study area can be decoded and well understood.

Good Luck!!!

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## Reviewer #1:

- As the authors claim in Line 54-56, the aim is to find factors that control the change and relationship with paleoclimate and paleoceanography. In my view, this aim should be strengthened by giving more evidence or discussions, although this work has achieved this goal in greater detail. One possible way is to compare the sediment provenance around the study region (maybe the NE SCS), the weather on land and sea.

### Reply:

We have provided additional background information and discussions to enhance the manuscript's explanation of paleoclimate and paleoceanography. These include changes in the ocean current intensity in the South China Sea during the deglaciation period (see lines 374 – 377), increased frequency of turbidity current after the LGM (see lines 379 – 380), and possible changes of sediment sources due to varying sea levels (see lines 396 - 400).

- I also recommend the authors to look into the hominid migration of Taiwan under this 'dramatic change', if possible, and it should be very interesting

### Reply:

According to previous archaeology and anthropology studies, Taiwan's oldest human culture, the Changpinian, is estimated to have migrated from southern China or Southeast Asia to Taiwan around 15,000 to 30,000 years ago. At that time (Period 2 in this study), the sea level fell and exposed part of the Taiwan Strait, serving as a passage for human migration. Moreover, about 6,000 years ago (Period 4 in this study), Austronesian peoples moved from south Asia to Taiwan by sailing after the sea level rise. Although the discussion on hominid migration and paleoclimate change is very interesting, it would exceed the scope of this manuscript and thus has not been added to the content.

- What is the possible path for the risen sea water pouring into the SCS?

### Reply:

The rising seawater was entering the SCS through the Luzon Strait. We have added relevant descriptions to the revised manuscript (see lines 374 – 376).

- Evolution of the channels KC and PC could be provided. These two channels are very close to the study area, the influences from them should be taken care very carefully.

### Reply:

Previous studies show that there is no significant lateral migration in the upper reach thalweg of the KC and PC. We mentioned this key information in the revised manuscript (see lines 96 – 97).

- Line 95-96: what is the velocity of the sediment for calculating the depths.

Reply:

We have added the sediment velocity (1,600 m/s) information in the revised manuscript (see lines 130 – 132).

- Fig.3a provides a very clear plain map of the depth to the erosion unconformity. It seems that the west flank of the GWR deposited much more than the east one. Can the author explain this?

Reply:

The sediment to the west of the GWR is much thicker than in the east could be due to mass transport deposits (MTDs) above the unconformity. We have added an explanation to the revised manuscript (see lines 190 – 193) and added a SBP profile (Supplementary Figure 2).

## **Reviewer #2:**

- The interpretation of contourite systems should be more reinforced. While the authors acknowledge the core site's distance from primary sediment pathways, its proximity to a network of densely distributed canyons or channels cannot be overlooked. Consequently, the possibility for these sediments to be formed by turbidity processes must be carefully evaluated. I recommend that the authors conduct a more detailed comparison of contourite versus turbidite depositional models to more convincingly rule out turbidite processes and support the contourite interpretation. What's more, the current interpretation of contourite facies relies too much on PSA results. Core data, including enlarged core photos, should be more involved in the analysis of depositional facies.

Reply:

We have reinforced the comparison in different fine-grained sediment facies, especially with fine-grained turbidite and contourite. We have also discussed the conditions for turbidite formation in more detail to exclude the possibility of sediment deposition in the study area through turbidity currents (see lines 255 – 266). Supplementary Figure 1 has been modified with enlarged core photos and CT images to strengthen the discussion sections in the revised manuscript.

- About the IWC. As far as I know, some previous studies on the IWC of the South China Sea seem much too subjective, relying too much on seismic data. Some key aspects of IWC, including its flow path, acting depths, and velocities, have not been fully revealed. I propose that the authors include a comprehensive, up-to-date synopsis of the IWC within the regional settings section of the paper. The use of ADCP data by the authors is great. However, the reported velocity of 17.4 cm/s appears high for deep-water bottom currents. Was it influenced by turbidity current? Could the authors elaborate on whether this velocity is consistent with findings from previous studies?

Reply:

The availability of indicators to understand past ocean current conditions is quite limited. That's why the previous IWC studies on the northern South China Sea relied heavily on seismic data and its interpretations. In the revised manuscript, we have added more background and recent oceanographic descriptions of the IWC (see lines 110 – 115) and added more discussion on the ADCP results (see lines 307 – 311) to make sure that a turbidity current does not contribute to the high bottom current velocity. Unfortunately, previous studies have not provided measurement data regarding IWC velocities in the northeastern South China Sea; however, the observation data in the western South China Sea shows the speed of IWC could reach 15 cm/s, which is close to the speed in our study area (17.4 cm/s).

**Reviewer #3:**

- The abstract seems to be starting abruptly without providing any background information and needs to be re-written.

Reply:

The abstract has been rewritten, improving the narrative sequence and providing more background information.

- The introduction doesn't provide any information about the aim of the present manuscript. It should be elaborated to bring out the significance of the present study and should be discussed well.

Reply:

The introduction has been extensively revised to provide more information about the purpose and significance of this study while also proposing additional issues for further discussion in the revised manuscript.

- Section 3.2.2: provide appropriate references and citations regarding the procedure and protocols.



Reply:

In the section of Data and Method, we have provided more information and references for sediment treatment (see lines 150 – 152).

- Section 3.2.3: Please provide relevant references for the regional reservoir age correction adopted in the present study and a modelled age-depth plot using appropriate software. Also, provide the median age for the respective ages.

Reply:

The “3.2.3 Radiocarbon dating” has added the regional reservoir information (see lines 166 – 168). The age-depth plot is provided in Supplementary Figure 3, based on calibrated results and created using MATLAB software. All the calibration ages in the revised manuscript are changed to the median age. We have revised the table content in Supplementary Table 1 with calibrated median age,  $1\sigma$  and  $2\sigma$  distributions.

- Exchange section 4.2 with section 4.3 so that the discussion in section 4.2 should be w.r.t the age along with the depths. Maybe the age can be mentioned in brackets such as in line 166: ‘... From core depth 575 to 600 cm (\_\_\_\_ cal yr to \_\_\_\_ cal yr BP) ...’.

Reply:

The Sections 4.2 and 4.3 has been exchanged, and the calibrated age has been mentioned in the 4.3 section for each sedimentation period (see lines 221, 227, 242, 275).

- Here authors have made the majority of the discussion on textural analysis however, they should also try to do some SEM and/or EPMA of the grains to provide better understanding and interpretation.

Reply:

We have taken SEM images for samples from four different core depths, representing different sedimentation periods (Period 1, Period 3-1, Period 3-2, Period 4). From the SEM analyses, we cannot find meaningful differences in these samples (as shown in the following figure). The sediment compositions and grain shapes are similar in hemipelagites and contourites because the formation of contourites was attributed to the reworking process of local sediments (e.g., hemipelagite) by bottom currents. However, other analytical methods in this manuscript could provide another point of view to distinguish different sedimentary facies. For example, the sedimentary structures seen from the CT

images, and the particle size analysis provides the current intensity information in each period.

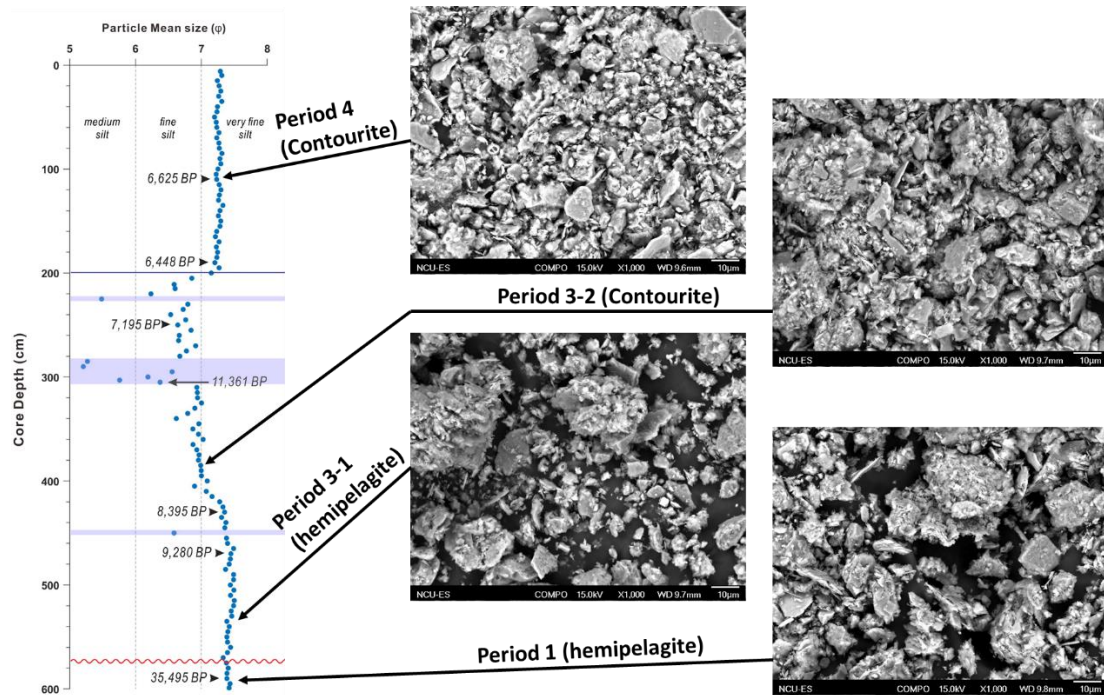


Figure: The SEM photos (x1000) in different core depths.

- The MS should also try to focus on the significance of the present study in global scenarios and not limit their interpretation in a local or regional scale.

Reply:

In the revised manuscript, we have noticed that the sea level fluctuations have affected the bottom current intensity and the sedimentary environment in the continental margin of the North Atlantic and Mediterranean Sea (see lines 367 – 369). Previous study shows that the climate variation during the last deglaciation has affected the intermediate water circulation strength in the western margin of the South China Sea (see lines 374 – 377). Thus, the scenario described in this manuscript supplies to a local and global scale.