ABRUPT CHANGES IN THE SOUTH CHINA SEA MIXED LAYER DEPTH DURING THE LAST 25 Ka

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Introduction

Asian Monsoon System paleorecords have shown abrupt climatic centennial-scale oscillations similar to the North Hemisphere (NH) high latitudes at North Atlantic 1,2. Here we investigate these climate-oscillations in the South China Sea (SCS) by reconstructing mixed layer depth (MLD) since the Last Glacial Maximum (LGM). The MLD was chosen as it responds to the atmospheric patterns driven by the East Asian Monsoon (EAM) 3.

Data and Chronology

We compiled a dataset composed of 11 PF published census records (>150 μm) from cores retrieved from the SCS (Figure 1). The ages were obtained from the published records based on δ18O stratigraphy or 14C dating (which were calibrated to calendar years with Calib 7.1).

Table 1. Core sites of planktonic foraminifera assemblage records from the SCS. (1) δ14C dating; (2) δ18O stratigraphy.

<table>
<thead>
<tr>
<th>Core (ID)</th>
<th>Lat (°N)</th>
<th>Long (°E)</th>
<th>Water depth (m)</th>
<th>Time interval (ka BP)</th>
<th>Data points</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIK 17940-2</td>
<td>20.11</td>
<td>117.38</td>
<td>1727</td>
<td>0.1 - 24.7</td>
<td>100</td>
<td>Pflaumann and Jian (1999) 4</td>
</tr>
<tr>
<td>MD97-2148</td>
<td>19.79</td>
<td>117.54</td>
<td>2830</td>
<td>0.1 - 24.9</td>
<td>160</td>
<td>Chen et al. (1999) 3</td>
</tr>
<tr>
<td>GIK 17938-2</td>
<td>19.47</td>
<td>117.32</td>
<td>2840</td>
<td>0.3 - 24.9</td>
<td>57</td>
<td>Chen et al. (1999) 3</td>
</tr>
<tr>
<td>31 KL</td>
<td>18.75</td>
<td>115.87</td>
<td>3360</td>
<td>14.4 - 15.9</td>
<td>14</td>
<td>Chen et al. (1998) 6</td>
</tr>
<tr>
<td>MD01-2394</td>
<td>13.78</td>
<td>110.25</td>
<td>2097</td>
<td>0.1 - 24.9</td>
<td>157</td>
<td>Yu et al. (2006) 7</td>
</tr>
<tr>
<td>MD97-2142</td>
<td>12.41</td>
<td>119.27</td>
<td>1557</td>
<td>0.08 - 24.3</td>
<td>39</td>
<td>Chen et al. (2003) 8</td>
</tr>
<tr>
<td>GIK 17957-2</td>
<td>10.53</td>
<td>115.18</td>
<td>2195</td>
<td>0.8 - 22.3</td>
<td>9</td>
<td>Jian et al. (2000) 9</td>
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<tr>
<td>MD97-2151</td>
<td>8.43</td>
<td>109.51</td>
<td>1589</td>
<td>0.1 - 24.7</td>
<td>82</td>
<td>Huang et al. (2002) 10</td>
</tr>
<tr>
<td>NS07-25</td>
<td>6.39</td>
<td>113.32</td>
<td>2006</td>
<td>2.6 - 24.6</td>
<td>31</td>
<td>Xiang et al. (2009) 11</td>
</tr>
<tr>
<td>MD01-2390</td>
<td>6.28</td>
<td>113.24</td>
<td>1545</td>
<td>1.0 - 24.4</td>
<td>46</td>
<td>Steinke et al. (2008) 12</td>
</tr>
<tr>
<td>GIK 18287-3</td>
<td>5.39</td>
<td>110.39</td>
<td>598</td>
<td>3.3 - 16.6</td>
<td>51</td>
<td>Steinke et al. (2001) 13</td>
</tr>
</tbody>
</table>

Deep-dwelling PF as a MLD Index

The percentage of deep-dwelling PF species (i.e., Globorotalia spp., Neogloboquadrina spp.) was applied to reconstruct MLD changes in the SCS over the last 25 ka. To obtain the MLD stack curves we divided the records into two groups and combined records to generate continuous (from 0 to 25 ka) records representing the North (records retrieved above 13°N) and South (records retrieved below 13°N) SCS.

Results and Discussion

In the northern sector records, both the LGM and the H1 are marked by relatively higher abundance of deep-dwelling PF species (Figure 2). Meanwhile, in the southern SCS we observed high abundances during the LGM followed by a stable shoaling of the MLD (Figure 2). During cold events the EAWM strengthenings are influenced by the intensification of the Siberian high-pressure system in response to cooling NH, resulting in cold and dryer northeasterly winds in the SCS 14.15. The abrupt changes recorded in the northern SCS sector and the less pronounced southern SCS may be a consequence of the latitudinal gradient of the EAWM impact, decreasing from N-S basin axis.

Figure 1. South China Sea and locations of cores used to compose the dataset.

Figure 2. Ice core δ18O reconstruction compared to SCS and continental proxies of EAM. Greenland δ18O record 16; Loess mean grain size of Gulang and Jingyuan (Chinese Loess Plateau) 17; Deep-dwellers (%) variability of northern SCS (this study); Deep-dwellers (%) variability of southern SCS (this study).

Conclusion

The abrupt climatic changes recorded in the SCS marine proxy was associated to the coupled ocean-atmosphere responses under the influence of the south shifted Siberian high-pressure system during LGM and H1 events.

Acknowledgments

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References

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