A New Discovery of Cretaceous (~125 Ma) migmatite in Liaodong Peninsula, North China Craton

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Objective

The North China Craton (NCC), especially its eastern region, had experienced extensive lithospheric thinning during Mesozoic (Zhu et al., 2011). Liaodong Peninsula is an important constituent of the eastern NCC, and recorded intensive lithospheric thinning-related magmatism and extensional deformation (e.g. metamorphic core complex; Liu et al., 2008; Zheng et al., 2018). Previous studies revealed that the activity of lithospheric thinning and cratonic destruction had reached the peak at ~125 Ma (Zhu et al., 2011). However, none of related Cretaceous metamorphic ages from Liaodong Peninsula had been reported yet. For the first time, we report a ~125 Ma anatectic age of a migmatite outcrop from the Shendianzi Village in Dandong city, Eastern Liaoning Province, China (GPS location: 40°10′33″N, 123°51′48″E). Combining with previous studies, we suggest that this ~125 Ma migmatite was resulted from partial melting related to the lithospheric thinning of the NCC during Cretaceous.

Methods

Zircons were extracted by conventional magnetic and density separation techniques and were further hand-picked under a binocular microscope, mounted in epoxy resin, and polished to approximately half-thickness. Cathodoluminescence (CL) imaging was undertaken by Nanjing Hongchuang GeoAnalysis, Nanjing, China. The zircon U-Pb analysis was performed using laser-ablation–inductively coupled plasma–mass spectrometry (LA–ICP–MS) housed at Yandu Zhongshi Geological Analysis Laboratories, Beijing, China.

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Results

The migmatite outcrop is mainly consisted of melanosomes (i.e. biotite felsic gneisses) and leucosomes. The dating sample SDZ-N1 is collected from biotite felsic gneisses, which are grey or dark-grey in color, showing a granular lamellar crystalloblastic texture and foliated structure defined by a preferred alignment of biotite. Minerals of biotite felsic gneisses include quartz (60%), plagioclase (25%), and biotite (10%), with accessory minerals (5%), including apatite, zircon, and monazite. All of these minerals are generally <1 mm in size. Furthermore, granitic leucosomes are widely distributed as irregular lenses, thin layers, and dykes in the host biotite felsic gneisses.

The zircons from sample SDZ-N1 are subrounded or rounded, and commonly show a core-rim structure in CL images (Fig. 1). Zircon cores have variable structures, including pronounced concentric oscillatory zoning or blurred irregular banding and zoning, which are indicative of detrital zircons. By contrast, the rims show planar zoning or unzoned indicative of a metamorphic origin. A total of seven rims and twenty cores had been analysed, the results are listed in Table 1. These seven rim analyses yield $^{206}\text{Pb}/^{238}\text{U}$ ages between 126 and 122 Ma with a weighted mean age of $125 \pm 2$ Ma (MSWD =0.47; Fig1). The Th/U ratios of these seven zircon rims are <0.1 (0.01–0.05) (Table 1), indicates that ~125 Ma is the timing of metamorphism. A total of twenty analyses on zircon cores yield variable $^{207}\text{Pb}/^{206}\text{Pb}$ ages ranging from 2537 to 1857 Ma, with Th/U ratios range from 0.07–1.24 (Table 1). These data of zircon cores show a dominant age group of 1921–1857 Ma (15 analyses) with a peak at 1875 Ma.

![Zircon U–Pb concordia diagram for the biotite felsic gneiss (SDZ-N1)](image)

**Fig. 1.** Zircon U–Pb concordia diagram for the biotite felsic gneiss (SDZ-N1)

**Table 1.** LA-ICP-MS U-Pb data of zircons from the migmatite (SDZ-N1)

<table>
<thead>
<tr>
<th>Spot</th>
<th>Th (ppm)</th>
<th>U (ppm)</th>
<th>Th/U</th>
<th>$^{207}\text{Pb}/^{206}\text{Pb}$</th>
<th>$^{206}\text{Pb}/^{238}\text{U}$</th>
<th>Isotopic ratios</th>
<th>$^{207}\text{Pb}/^{206}\text{Pb}$</th>
<th>$^{206}\text{Pb}/^{238}\text{U}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$\sigma$</td>
<td>$\sigma$</td>
<td></td>
<td>$\sigma$</td>
<td>$\sigma$</td>
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<tr>
<td>Zircon rims</td>
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<td></td>
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<tr>
<td>9</td>
<td>410.53</td>
<td>6.43</td>
<td>0.02</td>
<td>0.0502</td>
<td>0.0031</td>
<td>1.331</td>
<td>0.0091</td>
<td>0.0192</td>
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<tr>
<td>10</td>
<td>361.84</td>
<td>5.28</td>
<td>0.01</td>
<td>0.0481</td>
<td>0.0025</td>
<td>1.268</td>
<td>0.0064</td>
<td>0.0192</td>
</tr>
</tbody>
</table>

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A new Cretaceous (~125 Ma) anatectic age was reported in the southeastern margin of Liaodong Peninsula. Combining with previous studies, we suggest that this ~125 Ma migmaitite is resulted from partial melting related to the lithospheric thinning of the NCC. This study may also indicate that the eastern China not only experienced intensive magmatism and extensional deformation in Cretaceous, but also may record obvious anatexis.

Conclusions

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References

