Amplitude and timing of the last deglaciation warming in the Okinawa Trough constrained by alkenone sea surface temperature records

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We report alkenone sea surface temperature (SST) records of the last 30 kyr for core DGKS9603 (28°08.87′N, 127°16.24′E; 1100 m water depth) and core CSH-2 (31°13.73′N, 128°43.37′E; 703 m water depth) from the middle and northern Okinawa Trough, respectively. These millennial-scale records reveal deglacial warming of ca. 4°C, in agreement with most previous SST records from the Okinawa Trough. The amplitude is larger than SST changes at similar latitude of the open ocean Pacific, but is similar to SST changes of the western Pacific marginal seas, such as the northern SCS. Comparison with planktonic oxygen isotope records from the same sites reveals that the start of deglaciation warming at ca. 15 ka was synchronous with ice volume changes, and within age model uncertainties, synchronous with the warming in the Greenland ice core record and with the summer monsoon increase in the Hulu Cave record. Our results provide additional evidence revealing the spatial variability of the deglacial warming in the western Pacific: earlier warming (ca. 19ka) in the tropical and sub-tropical open Pacific, Bolling-synchronous warming in the marginal seas, and late warming (ca. 13ka) in the mid-latitude open Pacific. Our result is also consistent with earlier suggestions that the last deglaciation warming in the Okinawa Trough was responding to high-latitude northern hemispheric forcing through atmospheric circulation and monsoons.

Association of A- and I-type granites at the western Yangtze Block, SW China: Implications for generation of A-type granite

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Neoproterozoic magmatism in the Yangtze Block produced voluminous S- and I-type granites, and sparse A-type granites. The Shimian and Daxiangling plutons, which are composed of granite and alkaline-feldspar granite (AFG) respectively, are spatially associated along the western margin of the Yangtze Block. Zircon SHRIMP U-Pb dating shows that both plutons formed at ~800 Ma and are roughly contemporaneous with the TTG gneisses in the area. Geological evidence indicates that TTG rocks are the oldest and the AFG are the youngest.

The granites have high SiO_2 (69.3-76.6 wt%), Na_2O (2.79-3.80 wt%), K_2O (3.94-5.87 wt%), and low Fe_2O_3 (0.96-3.06 wt%) and MgO (0.12-0.50 wt%). The AFG have higher SiO_2 (76.3-79.3 wt%) and lower Al_2O_3 (10.6-11.9 wt%) and CaO (0.21-0.55 wt%). The AFG also have much higher Zr, Hf, Ga, HREE, and lower Sr than the granites. Both granite suites are slightly peraluminous (A/CNK = 1.00-1.12), and show similar and subparallel patterns on chondrite-normalized REE diagrams and primitive-mantle normalized spidergrams. They all show negative Eu, Nb, Ta, Sr, P, and Ti anomalies. They also have identical whole-rock Nd and zircon Hf isotopic compositions ($\varepsilon_{Nd}(t)$ = +1 and $\varepsilon_{Hf}(t)$ = +5 to +9), similar to those of the TTG. Geochemical features indicate that the granites are I-type, whereas AFG are A-type.

We suggest both the I- and A-type granites were derived from the TTG but under different pressure and temperature conditions. The I-type granites were produced by dehydration melting of TTG rocks as a result of underplating by mantle-derived mafic magmas. The rocks above the I-type magma source may have been converted to charnockites by heating and dehydration. With increasing temperatures, partial melting of the charnockites at temperatures >900°C could have produced the A-type magmas. These granites formed at an extensional active continental margin. A-type granites with mantle-like isotopic signatures may be reworked or recycled from juvenile crustal rocks. The association of A- and I-type granites described here suggests that A-type granites cannot be formed by direct melting of tonalites.