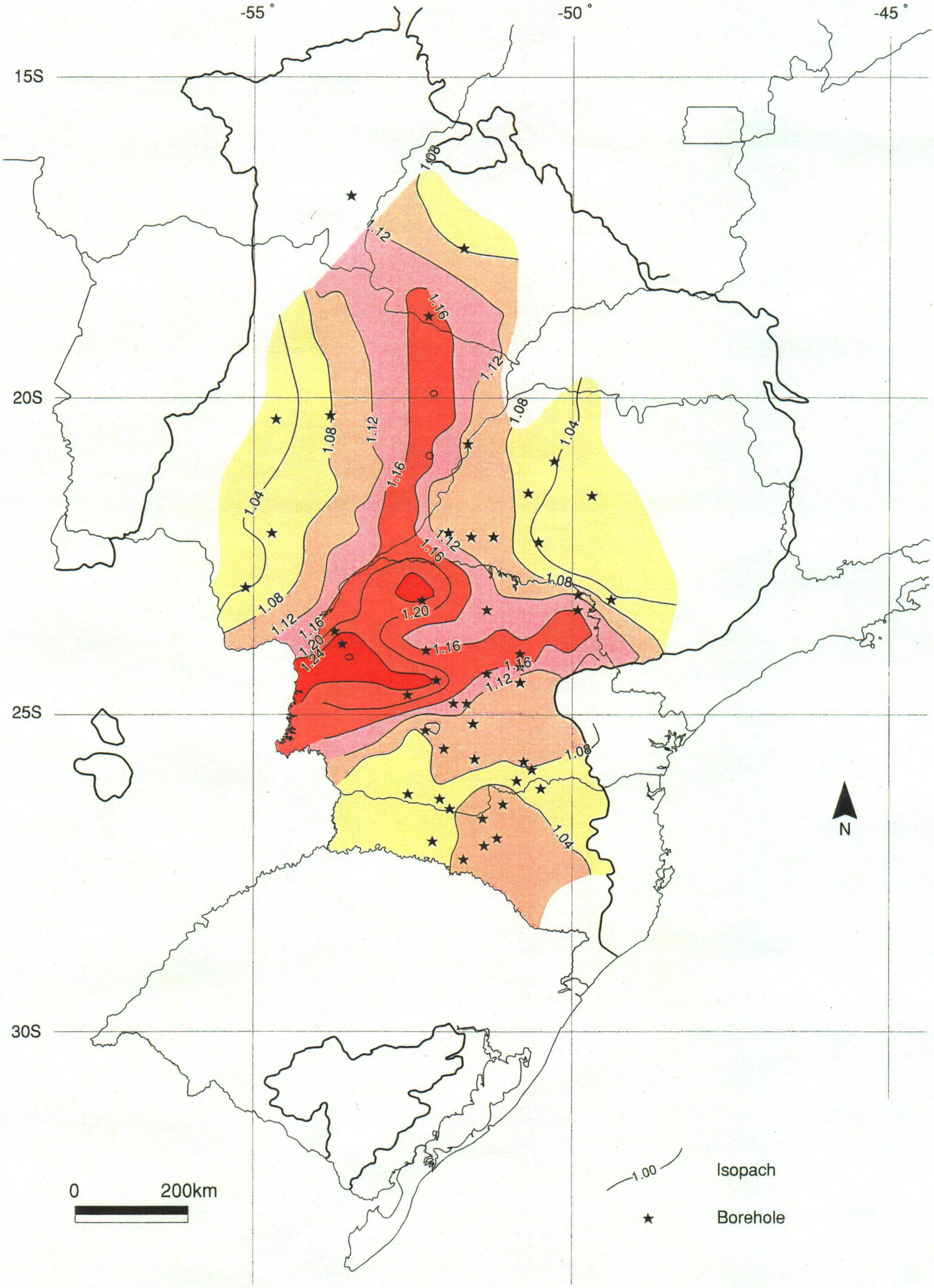

Fig. II-1-4-20 Iso-attenuation map of the first distensible event (440 Ma) (M.C.L. Quintas, 1995)

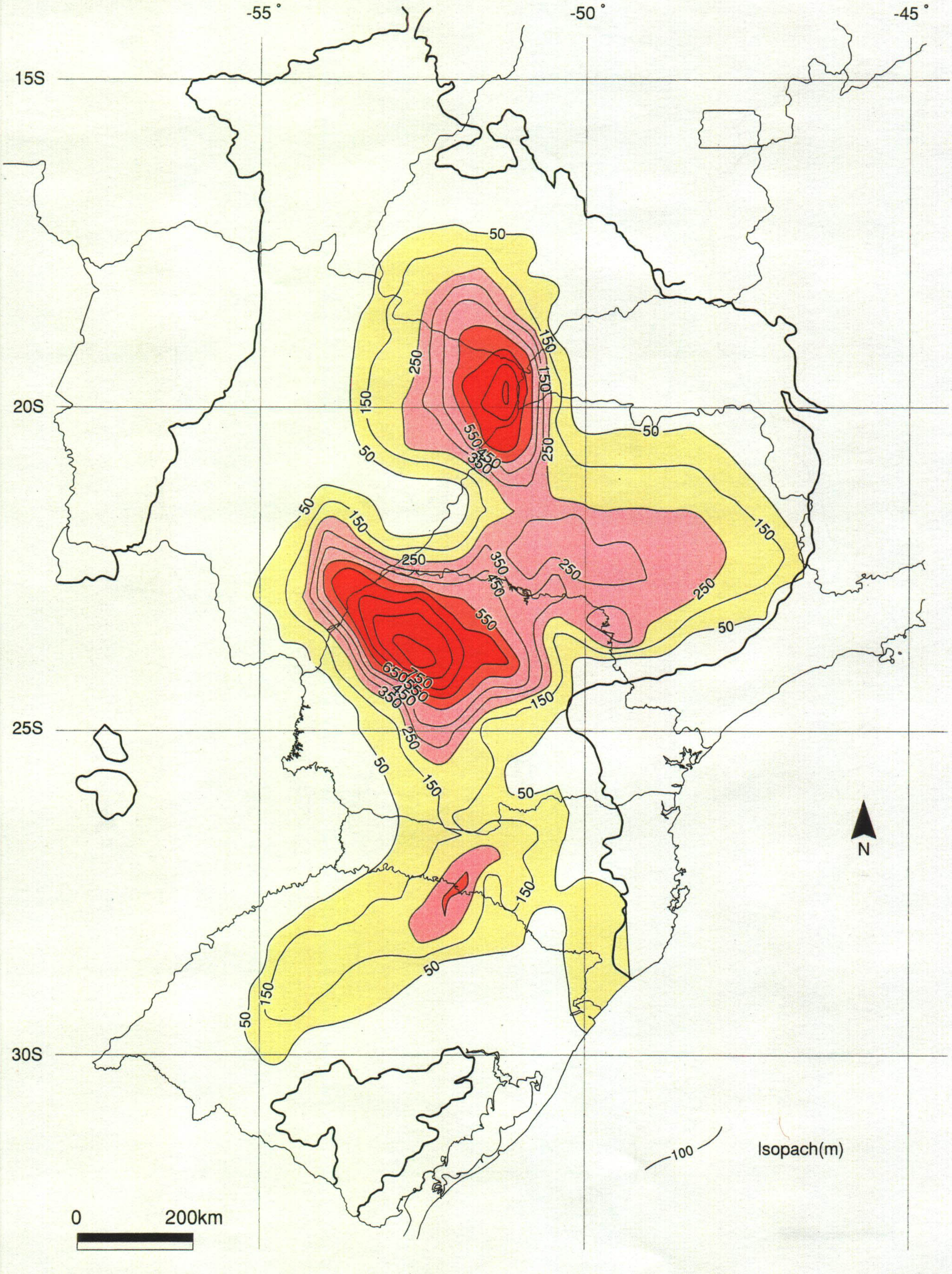

Fig. II-1-4-21 Accumulated thickness of sills, modified from Zalan et al, (1986) (M.C.L. Quintas, 1995)

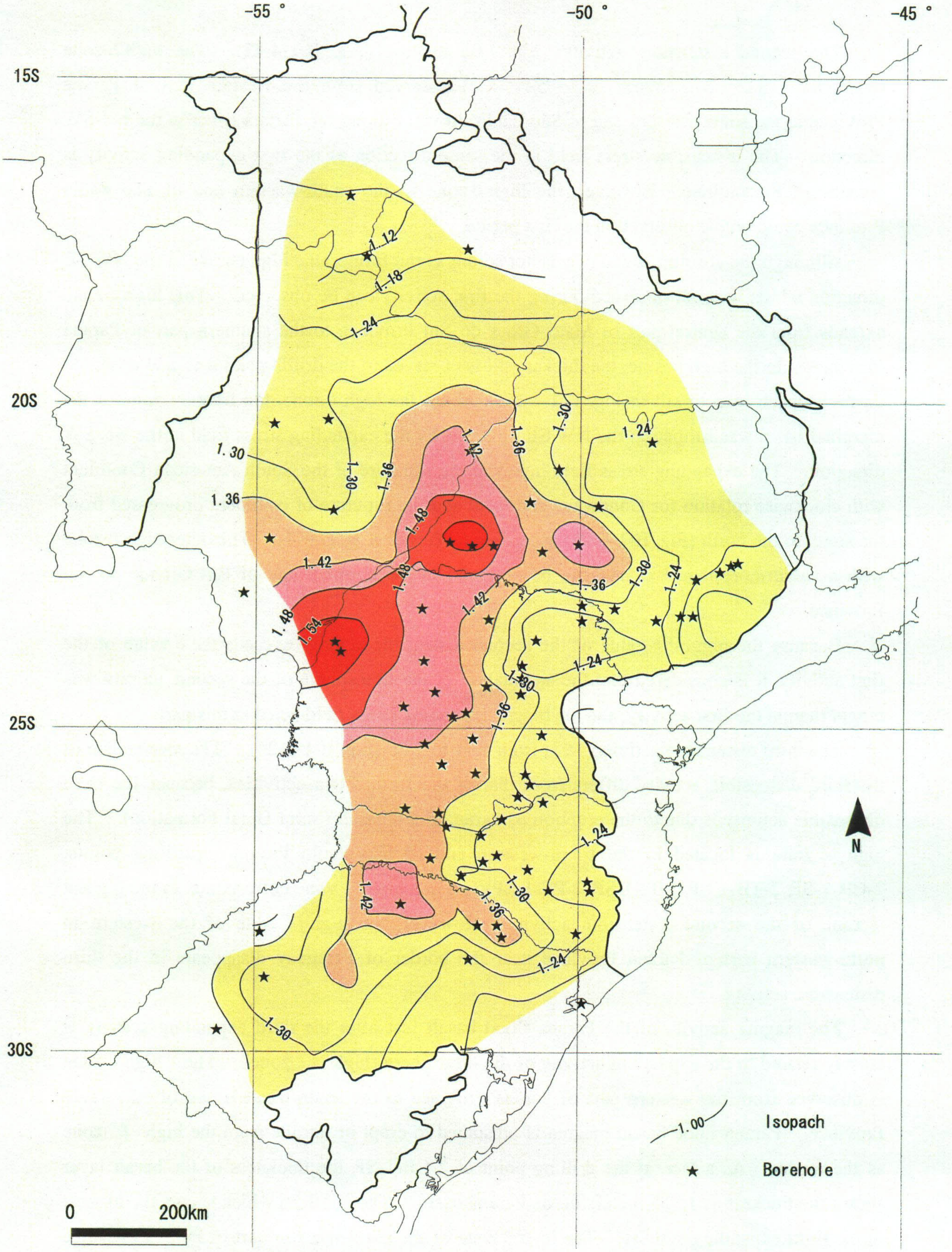

Fig. II-1-4-22 Iso- attenuation map of the second distensible event after the simulation of erosion (296 Ma) (M.C.L. Quintas, 1995)

The second distensible activity: ε is 1.06 to 1.61 (Fig. II-1-4-22). The high ε zone (S23° 8′ - S22° 3′, W53° 8′ - 52° 0′) observed from the western part of Paraná Province to the south-western end of São Paulo Province along the Paraná River in the NE-SW direction. The distensible stress field in the same direction as the first expanding activity is considered to continue. However, the high ε zone in the south-western end of São Paulo Province could not be observed in the first period.

Although the absolute value of ε is not so big as the former, the high ε zone in the NW-SE direction which was not observed during the first activity can be observed. This high ε zone extends from the central part of Mato Gross do Sul Province to the southern part of Paraná Province. In the high ε zone, the thickest sill is observed in the drilling and it is also observed on the isopach map of sill in Fig. II-1-4-21. About the high ε zone, the fracture zone or the marginal basin was formed in the NW-SE direction by the expanding stress field in the NE-SW direction. The expanding stress field involved the ruputure of the South American Continent with clockwise rotation for Gondwana continent and the ruputure of continent progressed from the south to the north (Fig. II-1-4-23) according to Turner et al. (1994). The other high ε zone with a value more than ε = 1.42 can be observed in the northern end of Rio Grande do Sul Province.

Because the biggest ε value of the second distensible activity exceeds the ε value of the first activity, it is considered that the attenuation of the lithosphere of the second activity was bigger than in the first activity, and the bigger expanding stress field acted in this part.

The third distensible activity: ε is from 1.01 to 1.26 (Fig. II-1-4-24). The mechanism of the third distensible activity differs from that of the former two activities, because the third distensible activity is due to the eruption of Paraná flood basalt (Serra Geral Formation). The high ε zone is located in the south-western end of São Paulo Province (drilling points: 2-CB-1-SP, 2-TB-1-SP, 1-TI-1-SP, 2-PE-1-SP) and this high ε zone corresponds to the highest ε zone of the second distensible activity. However, the high ε zone of the western to north-western part of Paraná Province near the border of Paraguay disappears in the third distensible activity.

The magma activity of the Paraná flood basalt just after the third expanding activity is closely related to the expanding activity of the lithosphere (high ε zone). The high ε zone is observed from the western part of Paraná Province to the south-western end of São Paulo Province. Paraná flood basalt magma is presumed to erupt or intrude from the high ε zone as the feeder. As a fact, at the drilling point of 2-CB-1-SP, the thickness of the basalt layer shows the thickest as 1,723 meters in the Paraná basin. The ε is 1.26 which shows the highest in the third expanding activity. The high ε zone of the north-western part of Paraná Province in the first expanding activity corresponds to the region where dykes and sills intruded the most.

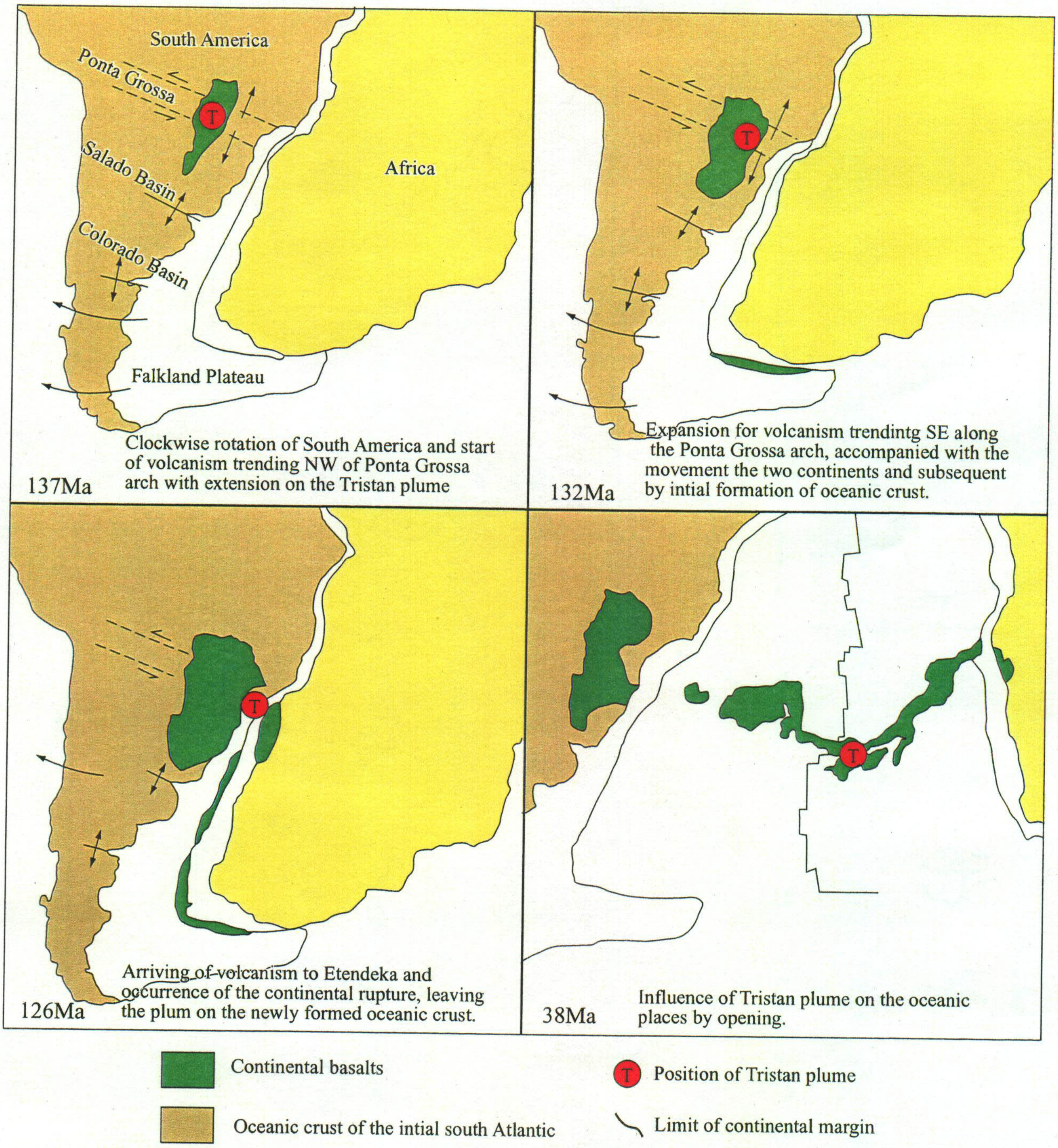

Fig. II-1-4-23 Sense of rupture of Gondwana (Turner et al., 1994)

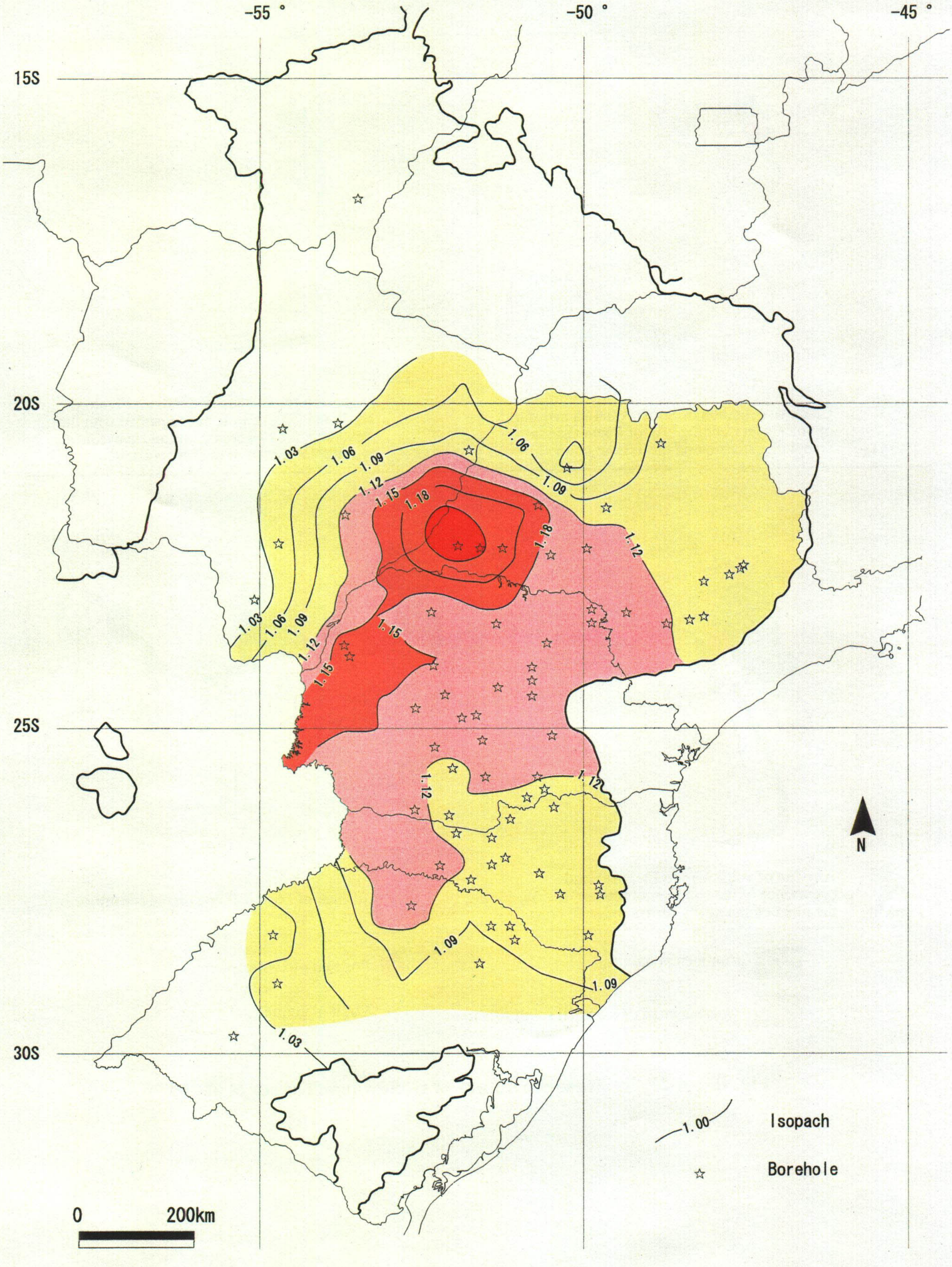

Fig. II-1-4-24 Iso-attenuation map of the third distensible event after the simulation of erosion (144 Ma) (M.C.L. Quintas, 1995)

c) Residual Gravity Anomaly by Isostasy Model

The Bouguer anomaly is shown in Fig. II-1-4-25. The isostasy model was calculated by using the following density values. Average density of the crust is 2.80 kg/m^3 (the value of the uppermost: 2.75 kg/m^3, in the middle: 2.80 kg/m^3, in the lowermost: 2.85 kg/m^3) and upper mantle: 3.33 kg/m^3. Here, the density of the sedimentary layer within the Basin is 2.55kg/m^3, the density of flood basalt is 2.87 kg/m^3 and the corrected Bouguer density is 2.67 kg/m^3 as the preconditions. The layers of the lower Basin is bent downward by isostasy and the lower crust is rooted to the mantle, which causes a minus Bouguer anomaly. The thickness of the root is determined by the rigidity D of the lithosphere, and is indicated by effective elasticity thickness Te. In this part, because the root of the crust is presumed to be supported by isostacy, D=0 was given. Under these preconditions, the gravity anomaly which was caused by the topography and the basin was calculated (Fig. II-1-4-26), and deducted from the measured gravity value (Fig. II-1-4-25). Furthermore, the residual gravity anomaly (Fig. II-1-4-28) was calculated after reduction of the regional trend by using the second order polynomial equation (Fig. II-1-4-27). The trend appears higher from SW to NE. This fact suggests the boundary of the lithosphere and asthenosphere becomes deeper toward the NE direction.

1) Residual Gravity Anomaly and High ε Zone

Low gravity anomalies are limited in the Ribeira belt in the south-eastern part of the basin, in the Brazilian belt in the north-eastern part of the basin and in the Paraguay belt in the north and the north-western part of the basin. High gravity anomalies are observed in the eastern part of Mato Grosso do Sul along the Paraná river from eastern Paraguay to the western part of Paraná Province, in the central part of São Paulo Province and in the north-western part of Rio Grande do Sul Province.

Comparing the residual gravity anomaly map (Fig. II-1-4-28) and attenuation (ε) map, in the case of the first expanding activity (Fig. II-1-4-20), the high gravity anomalies which are distributed along the Paraná River from east Paraguay to the western part of Paraná Province (in the NE-SW direction) and in the eastern part of Mato Grosso do Sul Province (in the N-S direction) correspond to the high ε zones. In the case of the second expanding activity (Fig. II-1-4-22), the high gravity anomalies which are distributed along the Paraná River from east Paraguay to the western part of Paraná Province, in the central part of São Paulo Province (in the NW – SE direction) and in the northern part of Rio Grande do Sul Province (in the NW-SE direction) correspond to the high ε zones. However, the high ε zones which are observed in the second expanding activity, that are distributed in the central part of Mato Grosso do Sul Province to the southern part of Paraná Province (in the NW-SE direction) do not reflect in the gravity anomaly. In the case of the third expanding activity (Fig. II-1-4-24), big high ε zones, which are distributed in the south-western part of São Paulo Province, correspond to the high

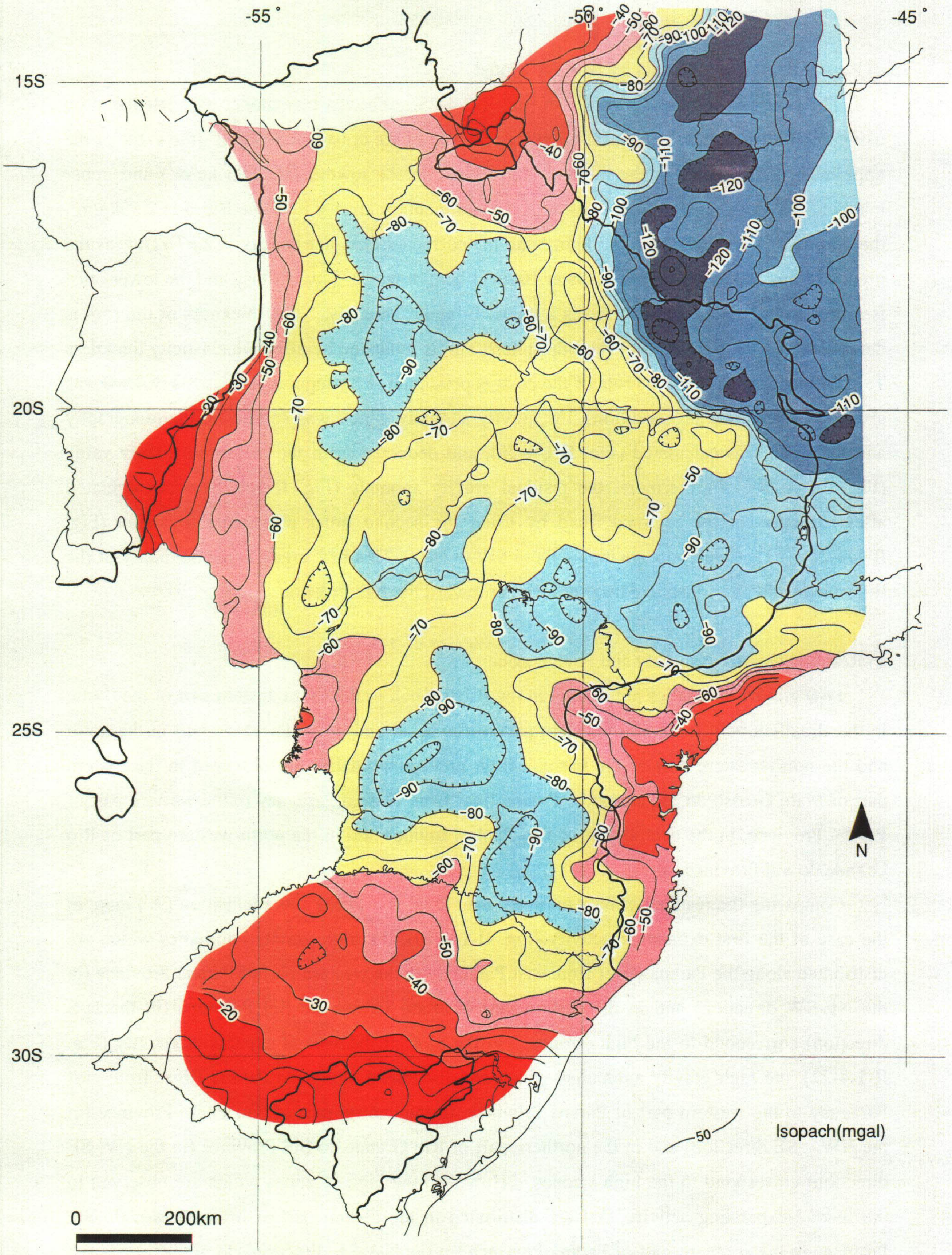

Fig. II-1-4-25 Bouguer anomaly calculated from observed data (M.C.L. Quintas, 1995)