**Df-021** Room: C309 Time: June 8 16:30-16:45

# Subsidences and stretching factors observed in extensional sedimentary basins

# Tadashi Yamasaki [1], Masao Nakada [2]

[1] Earth and Planetary Sci., Kyushu Univ., [2] Earth and Planetary Sci., Kyushu Univ

The simple stretching model proposed by McKenzie (1978) has been successful in explaining a history of basin subsidence. However, some contradictions between this model and observations are still discussed. These observed deviation from McKenzie's model may provide important information on the formation of the continental rift. In this paper, to discuss the formation of extensional sedimentary basins, we examine the subsidence histories observed in 12 provinces. Our results are as follows.

(1) Observed synrift subsidence is smaller than that for McKenzie model and its magnitude becomes larger as b-factor increases for almost of the lithosphere.

(2) For very thick lithosphere (200 and 225 km), larger stretching factors than b=2 are not observed in these sedimentary basins.

The simple stretching model proposed by McKenzie (1978) has been successful in explaining a history of basin subsidence with, a rapid synrift phase followed by a long-term thermal subsidence. However, some contradictions between this model and observations are still discussed, i.e., surface uplift, large amounts of thermal subsidence and late acceleration of postrift subsidence (e.g., Artyushkov, 1992; Ziegler, 1992). These observed deviations from McKenzie's model may provide important information on the formation of the continental rift. In this paper, to discuss the formation of extensional sedimentary basins, we examine the subsidence histories observed in 12 provinces. Our results are as follows.

(1) Observed synrift subsidence is smaller than that for McKenzie model and its magnitude becomes larger as b-factor increases for almost of the lithosphere. Thus, a larger upward buoyancy is required for a larger stretching factor. This upward buoyancy may be reproduced by the spinel-garnet phase transition. In fact, deviation from simple stretching model observed in Gulf of Lion and eastern Canadian margin was well explained by a stretching model with the spinel-garnet phase transition (Yamasaki & Nakada, 1997). The observed subsidence histories are systematically explained by a model with the phase transition, in which the depth of phase boundary is deeper for a thicker lithosphere. The depth of its phase boundary is strongly sensitive to ingredients of mantle rocks. MacGregor (1970) suggested that the extraction of basaltic components associated with the formation of continental crust results in the extent of the stability field of spinel lherzolite to higher pressure. On the other hand, Jordan (1978) suggested that differences in thermal structure and chemical composition between oceans and continents extended to the depth of about 400 km and the thickness of the lithosphere (tectosphere) beneath the old stable continents must have this magnitude. To be the very thick lithosphere in hydrostatic equilibrium with surrounding mantle, the subtraction of basalt-like components from mantle peridotites, leading to less dense than the parent rocks, is considered (Jordan, 1978). Thus, our result is consistent with basalt-depleted tectosphere model.

(2) For very thick lithosphere (200 and 225 km), larger stretching factors than b=2 are not observed in these sedimentary basins. While the simple stretching model satisfactorily accounts for the structure and subsidence of sedimentary basins, it does not provide the dynamical aspects for the origin and magnitude of the driving force for extension and the rheology of the lithosphere. b-factor is one of the most important parameters controlling the magnitude of subsidence and phase boundary movement. However, there are no answers for the question of what limits the amount of extension. According to the data presented here, the b-factor is limited to $b < 2$ for thick lithosphere whereas larger values have been observed for thin lithosphere. The rheological structure of the lithosphere is strongly dependent on its thermal condition (e.g., Brace & Kohlstedt, 1980; Kusznir & Park, 1987). Small stretching factor may be attributed to low geothermal gradient for thick lithosphere.