Thermal Evolution of the Tertiary Shimanto Belt, Southwest Japan: An Examples of Ridge-Trench Interaction

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This special volume is the result of a multidisciplinary study of the Shimanto Belt of the structural fabrics exposed within the Muroto Peninsula of Shikoku Island in Japan. The study was spurred by two Ph.D. dissertations, one by Jim Hibbard (at Cornell University) and the other by Lee DiTullio (at Brown University). These two geologists and their faculty supervisors interacted with geoscientists from Japan and the United States, studying the structural and thermal character of the Shimanto Belt.

This text consists of ten papers. The first summarizes the regional geology of Shimanto Belt and its relationship to the Eocene and middle Miocene thermal history of these rocks . It discusses the timing of structural events and interplate interaction, and ties these to the thermal history. The latter is derived from studies of the organic metamorphism of high-rank coals, and anomalous basic and acidic volcanic and plutonic rocks within the accretionary fore-arc. The general conclusion to this paper is that the temperatures of the area were enormously high for the relatively shallow depths, contradicting the model that low-temperature, high-pressure metamorphism would be expected within this subduction zone.

Following the introductory paper, the last nine papers deal with different aspects of measuring and modeling the thermal history of the area and its relationship to the structural deformation experienced by the region. In the first of these papers the authors describe how some 243 samples were collected on the Muroto peninsula across the Eocene Murotohanto subbelt along two separate northsouth coastal transects and several transects within the interior of the peninsula. Vitrinite reflectance values measured from these samples along these transects were related to structural and thermal history of the area. Very high values of thermal maturity were found and are thought to be related to the subduction of a very young oceanic crust and possible collision within an active or recently extinct spreading ridge.

The paper that follows ties temperature histories derived from both illite crystallinity and a vitrinite reflectance. The results show that thermal gradients can be better derived using two indicators and that these can enable the development of an elaborate picture for the geologic history of an area involving sedimentation, structure and plate movement.

The next paper provides further support to the contention that combining illite crystallinity and vitrinite reflectance data really help unravel the thermal history of an area and its structural evolution. While the initial papers of the text examine thermal gradients and thermal indicators locally, this study was extended to the accretionary prism which forms southwest Japan. Later papers compare the results derived from Cape Muroto with other sections along this southwest margin of Japan within the Shimanto Belt. Further papers examined other thermal indicators including fission-track thermochronologic studies and their relationship to the earlier sedimentary history of the area, while another paper considers the distribution of gas hydrate evidenced by bottom-simulating reflectors (BSRs). The final paper summarizes the history of the Shimanto accretionary complex and the relationship to field-based structural analysis and laboratory measurements of thermal maturity.

This book is probably forms one of the best examples of thermal history modeling for a region

relating this to the structural history of an area using a variety of thermal indicators. The authors describe well established technology to determine thermal history and have put together very tightly written and complete study of the region. It is because of the wide variety of people that are involved in the study, and the different studies they have made, that the book was broken down into the ten separate papers. There is some considerable overlap between some of the papers, but, nevertheless, a person wishing to gain an insight into the use of thermal indicators to determine the thermal history of an area will find this book very useful. Similarly, economic geologists wanting more information on the thermal history of southwestern Japan can gain some understanding of this from this book. Michael Underwood and the authors of these papers should be congratulated on very professional text.