The Contributions of Albert W. Bally to the Knowledge of Fold and Thrust Belts

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Abstract

Albert Bally had studied the Alps and Apennines, and also explored the Canadian Rockies and worldwide fold and thrust belts during his career at Shell, and later as a faculty at Rice University. As Chairman and Emeritus Professor at the Department, he directed research in the folded belts of Argentina, Canada, China, Colombia, France, Hungary, India, Italy, Mexico, Morocco, Peru, Romania, Spain, Switzerland, Turkey, United States, Trinidad and Venezuela. In a world of geophysicist versus geologists, Bally always encouraged and implemented the integration of surface and subsurface data, which during the fifties and sixties, represented an step forward from a typical methodological point of view. Bally and co-authors presented the first regional cross-section through a folded belt, integrating surface, seismic, and well log data. The pioneering cross-sections through the Canadian Rockies were published by Bally et al. in 1966 in the Canadian Journal. The key concept that detachment levels represent the boundaries of the building blocks of any orogenic system was developed during his life career. He and coworkers enhanced the concept of folded belts as detached and unrooted systems linked by a basal detachment, which culminated in the concept of “Orogenic Float”, which was successfully applied to the Canadian and U.S. Western Cordillera. In this model, oceanic B-type and continental A-type subduction slabs are detached from a complex system of thrust sheets, the upper allochthonous units are often affected by major strike slip or extensional systems detached from the same decollement surface. In addition, crustal, seismic and outcrop-scale structures, geometry of the fault systems was also integrated into this global scenario. Thanks to his worldwide experience in both basins and fold and thrust belts, Bally developed a Basin and Folded Belt Classification.

He played special attention to foredeep basins, developing the model of the “Ideal foredeep”, where concepts like basal foredeep unconformity, flexural extension, timing of deformation and the stratigraphy of the basin were incorporated. The integration of surface and seismic data allowed him to develop and clarify the concept of envelopment thrusting often confused with out of sequence thrusting. Applying his methodology, Bally could determine the precise timing of deformation within orogenic areas as shown in the initial balanced cross- sections, now widely used in both academia and petroleum exploration. He made special attention to pre-orogenic passive margin structures like salt, gravitational or preexisting extensional features to fully understand the evolution of fold and thrust belts.