

1. INTRODUCTION

These notes are designed to introduce the concepts and techniques of quantitative modeling of basin subsidence histories. The notes also describe some of the methods and results of modeling the development of sedimentary sequences generated by the interaction of subsidence, sediment supply, and sea-level changes. Analyzing and modeling basin subsidence can be a powerful tool for understanding how, when, and why basins form and, thus, compliments other basin analysis techniques. Subsidence analysis is useful for understanding regional tectonic history, history of sea-level changes, and the thermal history of basins that, in turn, are essential for diagenetic and hydrocarbon studies, and it also provides a basis for interpreting lithospheric structure and mechanics. In addition, quantitative models that take into account the competing effects of varying sediment supply rates, subsidence rates, and rates of sea-level change provide insights into the relative importance of tectonics versus eustatics in the generation of the basin-filling sequences. Comparison of the observed stratigraphy to that predicted by synthetic stratigraphic models of basin sequences can be used to help determine whether or not, and to what degree, basin deposition is controlled by tectonics or eustatics.

This course concentrates on the theory and application of subsidence and stratigraphic modeling by working through specific examples from real or artificial basin sequences. By the end of the course, you should be able to apply some of the basin-modeling techniques to your own studies and have a strong enough introduction to other techniques that you can understand most of the available literature. The outline of the course flows from the simple to the complex. We will first discuss basic concepts of subsidence mechanisms, geohistory analysis and compaction, backstripping and isostatic compensation, thermal mechanisms, and flexure (regional isostasy). Finally, we will discuss the relationship between basin subsidence, sea level, and the formation of stratigraphic sequences. The course is punctuated by case studies from our experience and the literature where these techniques and concepts are used to interpret various aspects of basin development. In addition, we have tried to cite much, but not all, of the relevant literature in the text and figures. Time, space, and the proliferation of recent publications in this rapidly

evolving field limits the scope of these notes and precludes a comprehensive overview.