More references on modeling of carbonate processes and stratigraph

Angevine, C. L., Heller, P. L. & Paola, C. (Ed.) (1990) Quantitative Sedimentary Basin Modeling. American Association of Petroleum Geologists, Continuing Education Course Note Series 32, 133 pp.

Aziz, S. K. ; Abd-El-Sattar-Mohamed-M, 1997, Sequence stratigraphic modeling of the lower Thamama Group, east onshore Abu Dhabi, United Arab Emirates in: GeoArabia (Manama). 2; 2, Pages 179-202.

We have included this reference because it deals directly with modeling of the Thamama Group.

AB: The Lower Cretaceous (Berriasian to Valanginian) Habshan Formation (Lower Thamama Group) of Abu Dhabi was deposited on a broad carbonate shelf. In east onshore Abu Dhabi, the Habshan Formation consists mainly of limestone and dolomite reaching a thickness of more than 1,100 feet. The depositional environment ranged from shallow-water peritidal to deeper shelf basin. The integration of seismic-stratigraphic, biostratigraphic, lithostratigraphic and electric log data reveals three sequences (I to III) and three shelf edges within the Habshan Formation in east onshore Abu Dhabi. These high energy shelfal sediments prograde toward the basin to the east and northeast with their shelf edges trending north-northwest to south-southeast. The seismic data indicates that the basin was filled in the east during the Hauterivian, after the deposition of Sequence IV (equivalent to the Zakum formation). Good reservoir development is found in the carbonates deposited in the high energy environment along the shelf edge of the Habshan sequence, particularly within the oblique and sigmoidal clinoforms, whereas potential source rocks are expected to be developed basinward. This combination renders the Habshan and Zakum sequences an attractive exploration target, both as structural and stratigraphic traps. Recent exploration activity in the area established the presence of hydrocarbons within the Habshan Sequence III in east onshore Abu Dhabi.

Bechstaedt-Thilo; Zuehlke-Rainer, 1996, Graus, R. R., Macintyre, I. G., and Herchenroder, B. E., 1984, Computer simulation of the reef zonation at Discovery Bay, Jamaica: hurricane disruption and long term physical oceanographic control: Coral Reefs, v. 3, p. 59-68.

Jacquin-Thierry; Graciansky-Pierre-C, 1997, Evaluation of Jurassic eustatic cycles; the results of the sequence stratigraphy of European basins project in: American Association of Petroleum Geologists 1997 annual convention p. 55.

ABSTRACT: Two critical points affect the credibility of global coastal on lap and sea level curves (1) the accuracy of the biostratigraphic calibration in support of the geochronology of sequence-cycle charts, (2) the evaluation of the different orders of sea level cycles. The first point has been the purpose of a regional compilation project, documenting Mesozoic sequences occurring within European Basins in a broad range of depositional and structural settings. More than 1000 well logs, from mid-Norway to SE France, have been calibrated to a precise biostratigraphic framework, and tied to age-controlled outcrop data where available. The result is an accurate sequence cycle chart, where the geochronology of most of third-order sequences can be shown at the resolution of the biostratigraphic tools. These age informations are an essential part of the stratigraphic forward-modeling techniques. The second point cannot be directly observed on the geological data base, which only allows the quantification of relative sea level changes, resulting from the effects of tectonic subsidence, sediment loading and compaction. These last two parameters can be easily separated. To separate eustasy from tectonic effects, it is necessary to backstrip various sections. By comparison of different accommodation curves documenting the Jurassic succession of several European Basins, a common signal interpreted as being induced by eustasy can be extracted. This signal was tested with PHIL, a 2D stratigraphic forward, modeling program, to reproduce the observed stratal geometries. This technique has been applied to realize its full potential to the time interval of the BRENT in the North Sea (Toarcian-Bajocian) and its European equivalents.

Leyrer-Karl; Strohmenger-Christian; Rockenbauch-Konrad; Bechstaedt-Thilo, 1995, Predicting reservoir facies distribution using high resolution forward stratigraphic modeling (Upper Permian Zechstein 2 carbonate, North Germany) in: AAPG international conference and exhibition; abstracts AAPG Bulletin. 79; 8, Pages 1231.

Navarre-Jean-Christophe; Bez-Martine, 1997, Accommodation:sediment supply ratio (A/S); a key parameter for stratigraphic modeling and reservoir architecture prediction in: 1997 AAPG international conference and exhibition; abstracts AAPG Bulletin. 81; 8, Pages 1400

ABSTRACT: Stratigraphic models predict the range of possible stratigraphic geometries and facies distributions between well control. The input parameters (including tectonics, eustasy and sediment supply) are constrained by the stratigraphic record derived from well log, core or field data. This stratigraphic record is best interpreted and modeled using one main parameter, A/S ratio. Surface and subsurface strata within the Mesa Verde Group (Upper Cretaceous), San Juan basin (Colorado) are subdivided into stratigraphic cycles of at least three temporal scales. All scales of cycles record oscillations of base-level and concomitant variations of increasing and decreasing A/S ratios. Cycle symmetry, stratigraphic architecture, facies assemblage and sediment preservation, between coastal-plain and shoreface strata, are function of their position in the long-term base level cycle. During long-term base-level fall hemicycle, in low accommodation settings: - Intermediate-term cycles in coastal plain strata are represented by crevasse splay/crevasse channel deposition and an erosional surface of unconformity formed during base-level fall hemicycles and an accumulation of amalgamated channelbelt sandstones on top of the unconformity surface during base-level rise hemicycles. - Intermediate-term shoreface cycles are recognized by changes in the aggradation to progradation ratio and are composed of heterogeneous sandstones. During long-term base-level rise hemicycle, in high accommodation settings: - Intermediate-term cycles in coastal plain are symmetrical. The base-level fall hemicycle consists of a gradual filling of lakes. During base-level rise hemicycle, facies successions are opposite and record gradual flooding of the floodplain. - Intermediate-term shoreface cycles are generally base-level fall asymmetrical and composed of homogeneous sandstones. Knowledge of these facies changes within a stratigraphic context is an invaluable aid to predict geometries and facies distributions. Consequently, accommodation curves based on stratigraphic cycles stacking pattern and facies interpreted in bathymetry value are essential for correlation and reservoir models.

Quinn-Terrence-M, 1991, The history of post-Miocene sea level change; inferences from stratigraphic modeling of Enewetak Atoll in: Special section on Long-term sea level changes, Journal of Geophysical Research, B, Solid Earth and Planets. 96; 4, Pages 6713-6725.

Sabine, C. L.; Mackenzie, F. T., 1995, Bank-derived carbonate sediment transport and dissolution in the Hawaiian Archipelago: Aquatic Geochemistry, v1 n2, pp 189-230.

ABSTRACT: The flux of bank-derived carbonate particles are consistently one to two orders of magnitude higher than the fluxes at the distal station. Furthermore, the mineralogy of the carbonate flux near the banks, which includes very soluble bank-derived aragonite and magnesian calcite particles, is distinctly different from that of the distal fluxes. Higher alkalinity and carbonate ion concentrations were observed in waters around all of the banks studied. The dissolution of some magnesian calcite and aragonite phases could explain the higher alkalinity values. Calculations suggest that the dissolution of benthically-derived aragonite and magnesian calcite may be an important component of the North Pacific alkalinity budget and a potential sink for anthropogenic CO "SUB 2" . -from AuthorsSpencer, R. J. & Demicco, R. V. (1989) Computer models of carbonate platform cycles driven by subsidence and eustasy. Geology, 17, 165-168.

Sims, D. L., 1992, Applications of 3-D geoscientific modeling for hydrocarbon exploration in: Turner, A.K., ed., Three-dimensional modeling with geoscientific information systems,

pp 285-289

ABSTRACT: Reviews two commercial 3-D modeling packages that run on Silicon Graphics Superworksatations. The packages are Dynamic Graphics, Inc.'s Interactive Volume Modeling (IVM) and Stratamodel, Inc.'s Stratigraphic GeoCellular Modeling (SGM). IVM's main strength is its ability to model, display and analyze variables (properties) that vary continuously in 3-D space. SGM utilizes a 'geo-cellular' approach that is 'well oriented'. SGMs main strengths are threefold. First, is the user's ability to model precisely the geology and distribute interpolated attribute values according to sequence/layer boundaries. Second, is the ability to carry up to 100 attributes for each cell. Third, is the SGM's 'filter' capability. Five models have been analyzed using IVM while two models have been analyzed using SGM. IVM and SGM are found to

complement each other by reinforcing the other's weakness. -from AuthorStrobel, J., Cannon, R., Kendall, C. G. S. C., Biswas, G. & Bezdek, J. (1989) Interactive (SEDPAK) simulation of clastic and carbonate sediments in shelf to basin settings. Computers & Geosciences, 15, 1279-1290.

Smith-Rouch-Linda-S, 1997, Climate variability in Desmoinesian carbonate cycles identified by stable isotope trends, variable Paleosols, diagenetic patterns, and stratigraphic modeling in: American Association of Petroleum Geologists 1997 annual convention, p. 108.

ABSTRACT

: Climate variability among glacial periods of Desmoinesian high-frequency platform carbonate cycles may be preserved in paleosols, stable isotope trends, and vadose diagenesis. The study evaluated lower Ismay Stage, Paradox Basin, SE Utah, outcrop sections near the Goosenecks area along the San Juan River. Within the Ismay Stage silcretes and calcretes alternately form on subaerial exposure surfaces. Subaerial exposure surfaces develop during the same system tract (LST) as basin evaporites precipitate, thus evaporite cycles should mimic the similar climate variations as platform silcretes or calcretes (relative humidity, air temperature, length of seasons, and etc.). Silcrete formation may indicate different relative humidity and pH values among glacial cycles from calcrete horizons. The depth of vadose zone diagenesis from each subaerial exposure surface provides a close proxy to minimum sea-level fall for each glacial period (LST). Stable isotope excursions from microcomponents identify indiscrete exposure surfaces that show little diagenetic overprinting with a negative carbon shift and small positive shift in oxygen. All cycles do not show the same shift, this may be due to variable microbial activity in soils, subsequent diagenetic overprinting, or climate. Stratigraphic modeling provides a dynamic tool to quantify and test values and assumptions obtained from collaborative studies (e.g. variations in sea-level amplitudes, time duration of systems tracts, evaporite precipitation rates, track platform margin/sea-level position (onlap) to monitor vadose zone depth and diagenetic overprinting from all cycles).Tinker, S. W., 1996, Building the 3-D jigsaw puzzle: applications of sequence stratigraphy to 3-D reservoir characterization, Permian Basin: American Association of Petroleum Geologists Bulletin, v80 n4, pp 460-485

This paper discusses the process of 3-D deterministic reservoir modeling and illustrates the advantages of using a sequence stratigraphic framework in 3-D modeling. Mixed carbonate and siliciclastic sediment outcrop and subsurface examples from the Permian basin of west Texas and New Mexico are used as examples, but the concepts and techniques can be applied to reservoirs of any age. Three-dimensional reservoir modeling results in an improved geologic interpretation; provides a means of integrating geological, petrophysical, geophysical, and engineering data; and allows for immediate model updates as new data are acquired. –AuthorWaltham, D. (1992) Mathematical modelling of sedimentary basin processes. Marine and Petroleum Geology, 9, 265-273. Watney, W. L., Wong, J.-C. & French Jr., J. A. (1991) Computer simulation of Upper Pennsylvanian (Missourian) carbonate-dominated cycles in western Kansas. In:

Sedimentary Modeling: Computer Simulations and Methods for Improved Parameter Definition (Ed. by E. K. Franseen, W. L. Watney, C. G. S. C. Kendall and W. Ross), Kansas Geological Survey Bulletin, 233, 415-430.

Georg Warrlich (Main Developer), CARBONATE 3D: A 3D stratigraphic forward simulator for carbonate platforms and mixed carbonate siliciclastic environments.

Wang Yong and Wang Yingmin, 1997, Computer modeling the sedimentation of carbonate platforms: Journal - Chengdu University of Technology, v24/2, 20-28

ABSTRACT: This paper introduces a quantitative method to simulate the sedimentation procedure in 2-D, by which one can study the model of sequence stratigraphy, predict the distribution of reservoirs, and modify the interpretation of well logs and seismic data. It can be used to check the exploration plan and to predict the basic factors of stratum formation. This article describes a numerical computer model that calculates the internal architecture of carbonate platforms in response to varying values of carbonate production, subaerial and submarine erosion, gravity transport and sediment redeposition.

Ye-Qiucheng; Kerans-Charles; Fitchen-W-M; Gardner-M-H; Sonnenfeld-M-D; Bowman-S, 1996, Forward stratigraphic modeling of the Permian of the Delaware Basin in: American Association of Petroleum Geologists 1996 annual convention, p. 156.

ABSTRACT: Permian platform-to-basin strata of the Delaware Basin in West Texas and New Mexico represent one of the world's most complete, best studied, and most hydrocarbon productive records of this geologic period in the world. This superb marriage of a refined stratigraphic framework and active exploration provided impetus to develop a forward stratigraphic model of this section to better predict the distribution of reservoir and seal relationships. The approximately 30 m.y. interval modeled is composed of 2 km of platform strata and 3 km of basinal strata divided into 8 composite sequences (average 3 m.y. duration) and 45 high-frequency sequences (400 ky m.y. duration). A 130 km dip section through the basin margin Guadalupe/Delaware Mountain outcrop is inversely modeled to derive local tectonic subsidence and a sea level curve for the Permian. In this process, the highest and lowest shoreline positions of each sequence are interpreted based on facies descriptions, which are assumed to approximate the highest and lowest relative sea level. A eustatic sea level curve is calculated by restoring these shoreline positions and removing local tectonic subsidence using a polynomial fit to the derived relative sea level curve. The quantitatively constrained curve for the Permian contains 2nd, 3rd, and 4th order signals with the 3rd-order amplitudes as great as 180 m. This quantitatively constrained accommodation history (calculated eustatic curve and subsidence history) are input into the PHIL forward modeling program. Model variables of sediment supply and depositional system are adjusted to match known outcrop relations. The resulting model is potentially capable of predicting stratigraphy elsewhere in the basin using only subsidence history data from the inverse model