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**Progradational Clastic and Carbonate Sequences Pennsylvanian
Hermosa Group, Paradox basin, Southwestern Colorado**

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ABSTRACT: Surface exposures of the shelf sediments Hermosa Group north of Durango in southwest Colorado record the history of shifting basin accommodation from early under-filled conditions to a two stage progradational shift towards the basin in late Desmoinesian (Gianniny and Miskell-Gerhardt, 2009). Conodont and fusulinid biostratigraphy permit tying these spectacular glacially-eroded outcrops to productive oil and gas intervals within the basin and to eustatic dominated cyclothems of the Midcontinent (Gianniny, Miskell-Gerhardt, and Ritter, 2008; Ritter et al 2002; Ritter and Barrick, 2010).

The early under-filled history is typified with the high amplitude cyclicity producing the alternating coal and sub-wave base carbonates of the Atokan Pinkerton Trail Formation (Connely and Gianniny, 2012). On the updip portions of the eastern shelf, this initial pulse of carbonate deposition is overlain by a clastic succession dominated by deltaic, and coarse, arkosic and lithic conglomeritic fluvial deposits. These updip deposits record the seasonally wet climatic conditions in western Pangea with the exceptional preservation of buried, upright trunks of *Calamites* and Lycopod forests developed on the floodplains of braided river systems (Eastep and Gianniny, 2013). It appears that these shelf clastics are roughly coeval with the “Alkali Gulch” oil and gas interval which includes the Cane Creek Shale and the very successful 12-1 horizontal well in the basin center. In between the highstand shelf deposits and organic-rich shales and dolomitic mudstones of the basin, on or just below the shelf margin, lowstand finer grained deltaic deposits alternate with black dolomitic mudstones in the Hermosa Group type locality near Durango, CO.

As a broader eastern shelf developed on this clastic apron, thin transgressive to highstand carbonates developed within the photic zone as indicated by phylloid algae and shallow water *Chaetetes* bioherms. Conodont biostratigraphy ties this interval to the “Barker Creek” oil and gas interval on the western shelf (Sequences 1-5 of Gianniny and Miskell-Gerhardt, 2009). Although subsidence and eustasy provided abundant accommodation space, as indicated by thick fluviodeltaic/carbonate sequences, sediment production began to overfill the southeastern margin during the upper portion of the Akah interval. Successive sequences prograded 6-10 km to the southwest (Sequences 7-10). Subaerial exposure surfaces on the top of shelf carbonates in this interval can be traced 15km downdip along the Hermosa Cliffs to onlapping lowstand to early transgressive evaporites. Although more biostratigraphy needs to be done, it appears that the thickest sequence, Sequence 11, may correlate with the thickest third-order sequence across the basin in the Desert Creek interval (DS-40, of Sarg, 2001). Sequences 12-15, mark a distinct basinward shift of deposition during the Ismay interval. Thick red paleosols top this interval across the eastern shelf surface outcrops. The uppermost pulse of marine deposition occurs in sequences 16-19. Phylloid algal bioherms in Sequence 16, with the fusulinid *Beedena magista*, tentatively correlates to the Honaker Trail Formation on the west side of the basin. Clastic input increases in the Desmoinesian carbonates of subsequent sequences 17-19 which also shift progressively

basinward. The sequences are overlain by the terrestrial facies deposits of the Cutler Formation in this area.

The exceptional outcrop exposures of the Hermosa Group on the eastern margin of the Paradox basin provide an opportunity to see the feedbacks between carbonate and siliciclastic deposits in a region of high subsidence and clastic input. They also provide specific insights to both basin dynamics and paleoclimate in this economically important basin.

Speaker Biography: Much of my research focuses on sequence stratigraphy of mixed carbonate clastic systems, the interaction of tectonic and climatic controls on sedimentation, paleontology, and the implications of sequence stratigraphy for aquifer and reservoir characterization and prediction. My most recent research with my undergraduate students centers around the sequence stratigraphy, microbial carbonates, and paleobotany of the Pennsylvanian Hermosa Group, and the sequence stratigraphy and diagenesis of the Mississippian Leadville Limestone. In addition working with co-authors, I have also investigated the impacts of dams on riparian aquifers, sediment storage, and the resultant changes in plant communities on the Dolores, Animas, and San Juan Rivers in southwestern Colorado and southeastern Utah. Much of this research is in collaboration or cooperation from industry, governmental scientists, and regional stakeholder groups.

B.A. in Geology from Colorado College, and an M.S. and Ph.D. from the University of Wisconsin, Madison, Carbonate research geologist, Wisconsin Geological Survey 1995, Post-Doctoral Research, Idaho State University 1996-1997, Visiting Professor Department of Geology, Bucknell University 1996-1999, Assistant Professor, Associate Professor, and Full Professor, Fort Lewis College Department of Geosciences, 1999-Present.

Professional Affiliations: GSA, SEPM, AAPG, IAS, RMAG, International Society for River Science, Four Corners Geological Society.

Awards: Fort Lewis College Scholar of the Year, 2011; Commencement Speaker, December 2011, Fort Lewis College; Honorable Mention awarded by SEPM: Poster co-authored with Kim Miskell-Gerhardt, 2007 AAPG National meeting.

Service: Four Corners Geological Society President 2001-2002, 2013-14, Vice President 2000-2001, 2012-2013, Four Corners Geological Society Foundation Board member, 2008-Present, Mountain Studies Institute Board of Directors 2001-2008 ; Technical Session Co-Chair, Rocky Mtn Section AAPG meeting, 2010, Delegate Rocky Mountain Section APPG 2013-2014, Technical Session Co-Chair, Rocky Mtn Section GSA meeting, 2013.

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