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2009-2010 PROJECTS

SE ALASKA - EXHUMATION OF THE COAST MOUNTAINS BATHOLITH DURING THE GREENHOUSE TO ICEHOUSE TRANSITION IN SOUTHEAST ALASKA: A MULTIDISCIPLINARY STUDY OF THE PALEOGENE KOOTZNAHOO FM.

Faculty: Cameron Davidson (Carleton College), Karl Wirth (Macalester College), Tim White (Penn State University)

Students: Lenny Ancuta, Jordan Epstein, Nathan Evenson, Samantha Falcon, Alexander Gonzalez, Tiffany Henderson, Conor McNally, Julia Nave, Maria Princen

COLORADO – INTERDISCIPLINARY STUDIES IN THE CRITICAL ZONE, BOULDER CREEK CATCHMENT, FRONT RANGE, COLORADO.

Faculty: David Dethier (Williams) Students: Elizabeth Dengler, Evan Riddle, James Trotta

WISCONSIN - THE GEOLOGY AND ECOHYDROLOGY OF SPRINGS IN THE DRIFTLESS AREA OF SOUTHWEST WISCONSIN.

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OREGON - SOURCE TO SINK – WEATHERING OF VOLCANIC ROCKS AND THEIR INFLUENCE ON SOIL AND WATER CHEMISTRY IN CENTRAL OREGON.

Faculty: Holli Frey (Union) and Kathryn Szramek (Drake U.)

Students: Livia Capaldi, Matthew Harward, Matthew Kissane, Ashley Melendez, Julia Schwarz, Lauren Werckenthien

MONGOLIA - PALEOZOIC PALEOENVIRONMENTAL RECONSTRUCTION OF THE GOBI-ALTAI TERRANE, MONGOLIA.

Faculty: Connie Soja (Colgate), Paul Myrow (Colorado College), Jeff Over (SUNY-Geneseo), Chuluun Minjin (Mongolian University of Science and Technology)

Students: Uyanga Bold, Bilguun Dalaibaatar, Timothy Gibson, Badral Khurelbaatar, Madelyn Mette, Sara Oser, Adam Pellegrini, Jennifer Peteya, Munkh-Od Purevtseren, Nadine Reitman, Nicholas Sullivan, Zoe Vulgaropulos

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Faculty: Greg Wiles (The College of Wooster), Tom Lowell, (U. Cincinnati), Ed Berg (Kenai National Wildlife Refuge, Soldotna AK)

Students: Alena Giesche, Jessa Moser, Terry Workman

SVALBARD - HOLOCENE AND MODERN CLIMATE CHANGE IN THE HIGH ARCTIC, SVALBARD, NORWAY.

Faculty: Al Werner (Mount Holyoke College), Steve Roof (Hampshire College), Mike Retelle (Bates College)

Students: Travis Brown, Chris Coleman, Franklin Dekker, Jacalyn Gorczynski, Alice Nelson, Alexander Nereson, David Vallencourt

UNALASKA - LATE CENOZOIC VOLCANISM IN THE ALEUTIAN ARC: EXAMINING THE PRE-HOLOCENE RECORD ON UNALASKA ISLAND, AK.

Faculty: Kirsten Nicolaysen (Whitman College) and Rick Hazlett (Pomona College)

Students: Adam Curry, Allison Goldberg, Lauren Idleman, Allan Lerner, Max Siegrist, Clare Tochilin

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**Keck Geology Consortium: Projects 2009-2010
Short Contributions – MONGOLIA**

**PALEOZOIC PALEOENVIRONMENTAL RECONSTRUCTION OF THE GOBI-
ALTAI TERRANE, MONGOLIA**

Project Directors: **CONSTANCE M. SOJA**: Colgate University
CHULUUN MINJIN: Mongolian University of Science and Technology
Project Faculty: **PAUL MYROW**: The Colorado College
D. JEFFREY OVER: State University of New York at Geneseo

**CHEMOSTRATIGRAPHY OF THE LOWER SILURIAN SCHARCHULUUT
FORMATION, YAMAAN-US, SHINE JINST REGION, GOBI-ALTAI TERRANE,
MONGOLIA**

UYANGA BOLD: Mongolian University of Science and Technology
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BILGUUN DALAIBAATAR: Mongolian University of Science and Technology
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TIMOTHY M. GIBSON: Colorado College
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MADelyn METTE: Macalester College
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SEQUENCE STRATIGRAPHY AND PALEONTOLOGY OF THE UPPER ORDOVICIAN DARAVGAI AND GASHUUNOVOO FORMATIONS, GOBI-ALTAI TERRANE, SHINE JINST, MONGOLIA

SARA E. OSER: University of Cincinnati
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PALEOECOLOGY OF LOWER DEVONIAN (EMSIAN) SHELF DEPOSITS IN THE CHULUUN FORMATION, GOBI-ALTAI TERRANE, MONGOLIA

ADAM FRANCIS ANTONIO PELLEGRINI: Colgate University
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JENNIFER A. PETEYA: Mount Union College
Research Advisor: Lee Gray

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PALEOECOLOGY AND CHEMOSTRATIGRAPHY OF THE AMANSAIR AND TSAGAANBULAG FORMATIONS, GOBI-ALTAI TERRANE, MONGOLIA

NADINE G. REITMAN: Vassar College
Research Advisor: David P. Gillikin

**THE EIFELIAN GIVETIAN BOUNDARY (MIDDLE DEVONIAN) AT TSAKHIR,
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NICHOLAS SULLIVAN: State University of New York at Geneseo
Faculty Advisor: D. Jeffrey Over

**PALEOENVIRONMENTS AND DEPOSITIONAL HISTORY OF UPPER
SILURIAN-LOWER DEVONIAN LIMESTONE IN THE AMANSAIR AND
TSAGAANBULAG FORMATIONS AT ULAANSHAND AND TSAKHIR, GOBI-
ALTAI TERRANE, MONGOLIA**

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ADAM FRANCIS ANTONIO PELLEGRINI: Colgate University
 Research Advisor: Constance M. Soja

INTRODUCTION

Central Asia formed during the late Paleozoic-early Mesozoic when multiple crustal fragments came together to create the general central Asian landmass. Specific to Mongolia, this amalgamation process involved as many as 44 tectonic pieces, or “terrane” (Badarch et al. 2002). In southern Mongolia, a backarc basin was squeezed in between other crustal fragments to form the present day Gobi-Altai terrane. Within the Gobi-Altai terrane, the Shine Jinst region contains multiple rock beds of ages spanning the Ordovician to the Early Permian (Wang et al. 2005; Badarch et al. 2002).

With Mongolia’s position in the Paleozoic still under question, documenting the paleoecology of the Gobi-Altai terrane will help provide insights into the Paleozoic placement and climate regime of this particular terrane. Combined with other data, this study will assist in determining the approximate proximity of the Gobi-Altai terrane to other terranes, land masses and their biotas. Documenting this may help explain how climate factors, depositional sites, and localized tectonic events shaped the Gobi-Altai paleocommunities.

The Chuluun Formation is Emsian (Early Devonian); stratigraphically it occurs between the Tsakhir (Lower Devonian) and the Tsagaankhaalga (Middle Devonian) formations in the Tsakhir basin (Wang et al. 2005). This investigation into the Chuluun Formation provides new information about marine environments and their inhabitants of that area during the Emsian. The investigated stratigraphic interval is the first thick carbonate buildup that formed after a long interval of clastic deposition. The rocks underlying this section consist of massive conglom-

erate that grade upward into alternating shale and volcanic beds before deposition of the limestone I examined. For a more detailed analysis of the underlying rocks, please refer to Gibson (this volume).

MATERIALS AND METHODS

The limestone in this study forms a 75 m-thick section, which was measured along a single transect beginning at the base of the Chuluun Formation. The detailed stratigraphic column is based on the analysis of the rock and fossil types examined within 2 m of that transect (Fig. 1). At two sites of excep-

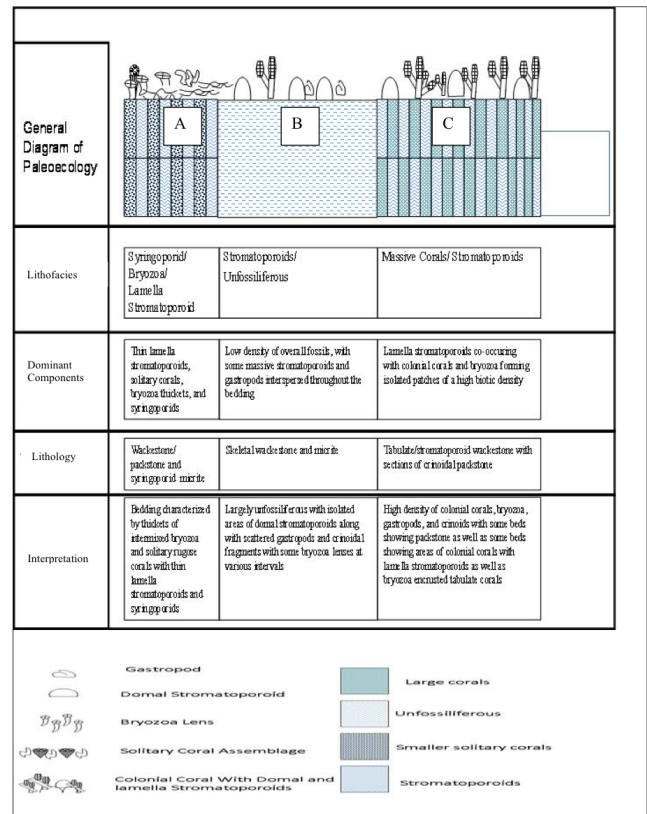


Figure 1. Comprehensive diagram illustrating lithofacies, dominant faunal components, and lithology of the section from 0.3-69 m.

tional fossil preservation, more detailed descriptions and sketches of faunal relationships (accurate to +/- 0.1 m) were made (from 45-51 m and 66-71 m, respectively, above the base of the formation).

Samples were collected at every 2 m with an accuracy to 0.5 m. Additional samples were chosen of representative taxa in the paleocommunities examined. A total of 72 thin sections was prepared, all normal to bedding, and analyzed using a polarizing microscope. The lithologic composition was quantified by collecting point-counted data (N=300) on samples collected at every 4 m. The beds along the transect are vertically oriented, approximately 0.5-1.0 m thick, and composed of fossiliferous mudstones, wackestones, and packstones. The point-counted data are displayed in a histogram with trend lines of abundance patterns (relative to each organism type) (Fig. 2). A histogram plot shows 10 m groupings with relative abundance on the x-axis and stratigraphic height on the y-axis (Fig. 2).

RESULTS

Bryozoans, massive and lamellar stromatoporoids, and colonial corals are the dominant fossils in my section. Thin sections, point-counted data, and field notes yield consistent results about the relative abundance of stromatoporoids in the section (Table 1). For example, both thin section and point count analysis show that the deposits from 30-40 m are characterized by abundant, large (15-25 cm in diameter) stromatoporoids, which are associated with crinoids, coral, and bryozoa.

Facies	Dominant Biotas	Thickness Based on Field Evidence	Thickness Based on Thin-Section Data	Thickness Based on Point-Count Data
A	Syringoporid/Bryozoa/Lamellar Stromatoporoid	0-12 m	0.3-19 m	0-10 m (Stromatoporoids) 10-20 m (Syringoporoids)
B	Stromatoporoids/Unfossiliferous	14-44 m	21-41 m	30-40 m
C	Massive Corals and Stromatoporoids	44-69 m	43-69 m	50-60 m
D	Syringoporid/Bryozoa	69-73 m	69-73 m	60-73 m (Stromatoporoids)

Table 1. Chart showing subdivisions of the stratigraphic sequence into four facies using three datasets

Thin sections, point-counted data, and field observations revealed that smaller (5-10 cm in diameter) solitary corals were abundant from 0-20 m and also from 69-73 m. Larger colonial corals (10-20 cm in diameter) were abundant from 44-69 m (Table 1). Bryozoans were too small to be noted in field observations, but thin sections and point count analysis showed that they are relatively consistent in abundance, with a slight peak near the base and the top of the section. Differences between the point count and the thin section data might have arisen because 1) point counts were only done on a subset of thin sections and 2) in the thin section data, organisms were classified as either present or absent but the point count data allowed their degree of presence to be estimated. The observed patterns of biotic abundance in my section (first being dominated by bryozoans, followed by massive stromatoporoids and corals, then by lamellar stromatoporoids and bryozoans) reveals that there might have been different abiotic factors between the middle and the upper/lower sections. Photomicrographs of the organisms are in Figure 3.

DISCUSSION

The examined stratigraphic interval does not display evidence for a gradual shallowing or deepening through time: bedding, overall fossil composition and the preservational state of fossils remain consistently uniform. There are no wave ripples, interbedded siliciclastic rocks, or other supratidal or intertidal indicators. Also, delicate bryozoan branches are largely preserved intact thus suggesting a calm, shallow subtidal environment. A comparison with deeper water habitats described in the literature also demonstrates that the section did not form on a deep marine shelf. For example, other studies report that Emsian, deep water ramp environments were characterized by a high abundance of cephalopods (specifically nautiloids) (Lubeseder 2008), which are not evident in the Chuluun Formation. Vertical burrows, which are common in intertidal environments of Devonian age, are absent from the section. With the presence of organisms that had the potential to build reefs (Fig. 1; Table 1), comparison with other areas where reefs developed is necessary

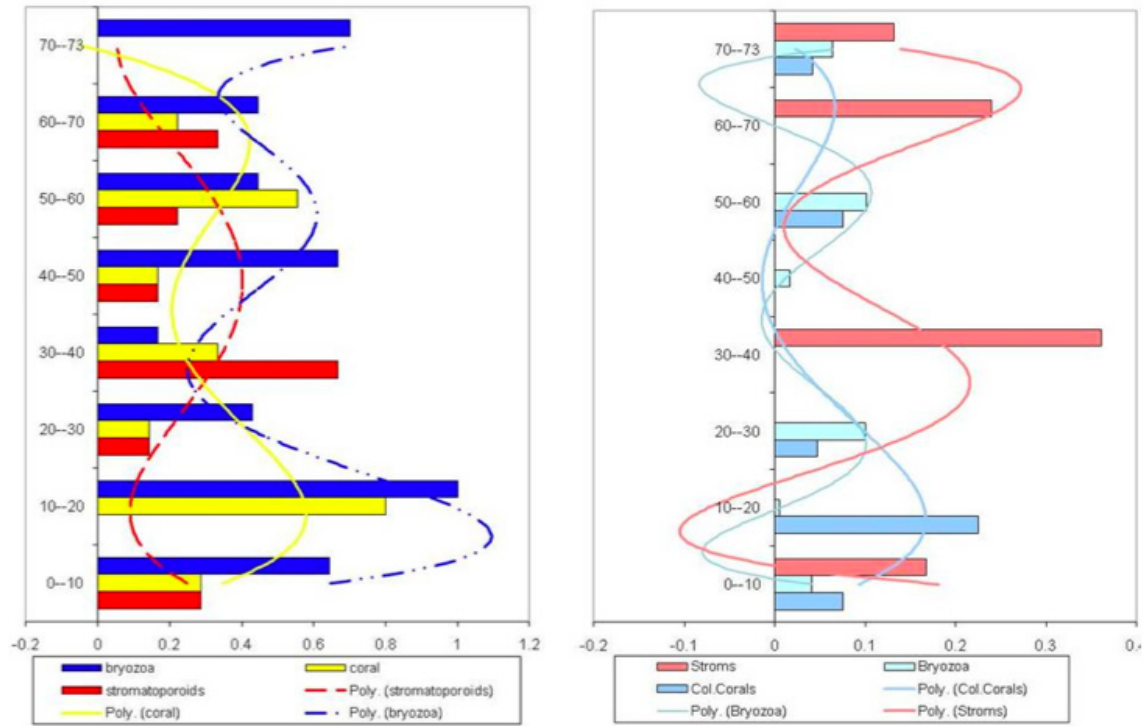


Figure 2. Relative abundance of fossils revealed in thin section analysis (left) and point-counted data (right).

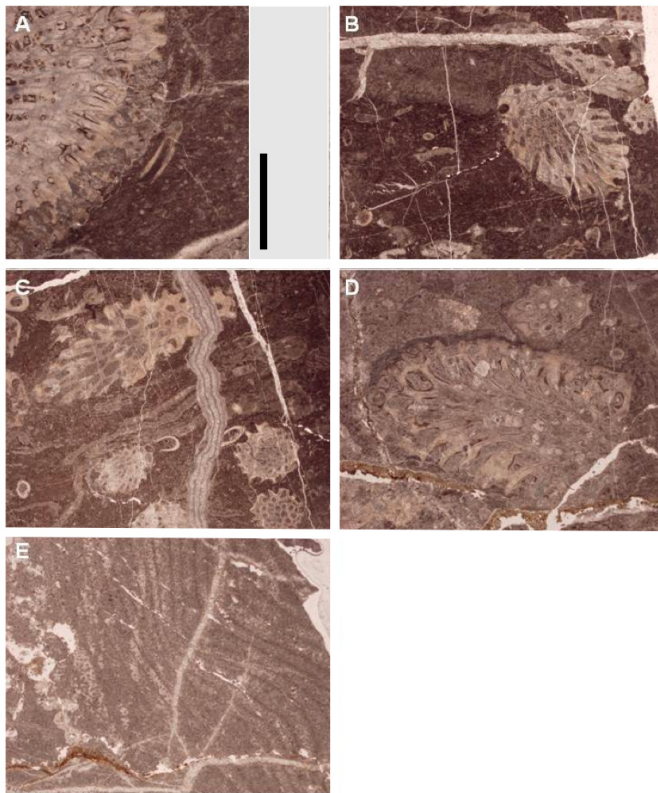


Figure 3. Photomicrographs showing: A) coral in float; B) bryozoan wackestone typical of lower 12 m of section; C) bryozoan wackestone with coral and stromatoporoid; D) coral characteristic of lower 12 m of section; note its microbial rind; E) stromatoporoid characteristic of the middle section. The 5 mm scale in A is the same for all images, and photomicrographs are oriented so that the top edge is up.

to determine if the section under study represents a reef buildup.

An overview of Devonian reefs that formed in the Urals, China, and Laurentia was conducted by reading the published literature. Those areas are hypothesized to have had a similar latitudinal position to Mongolia in the Early Devonian and may have been in close geographic proximity to southern Mongolia (as proposed by Copper and Scotese 2003). Though my section is composed of massive, calcareous organisms that had the potential to build reefs, they do not form the massive boundstones present in other Emsian reefs (Antoshkina and Konigshof 2008; Shen et al. 2008). Nor are the organisms found intergrown or in high concentrations like those evident in other Emsian reefs. Factors that may have prevented reef formation are discussed below.

The underlying deposits of the Tsakhir Formation represent an interval of tectonic activity and pro-

longed deposition of terrigenous sediment on land and in adjacent shallow-marine sites (see T. Gibson contribution in this proceedings volume). The Chuluun Formation represents the first widespread accumulation of carbonate sediments in the wake of that tectonic event. For a newly submerged shelf to be colonized by marine species, it requires the immigration of organisms, including their larvae, from nearby areas. The isolation of Mongolia in the Early Devonian, as suggested by Copper and Scotese (2003), may explain why the shallow-marine biotas of the lower Chuluun Formation exhibit minimal ecologic structure and are relatively low in diversity and abundance during the earliest stages in recolonization of the shallow marine shelf. Limited accommodation space on a slowly subsiding shelf and paleolatitudinal location may have also contributed to the slow recovery and minimal ecologic succession of Emsian shallow marine communities in the Gobi-Altai terrane.

CONCLUSIONS

Emsian carbonate strata of the Chuluun Formation formed in a quiet, shallow marine shelf environment. There is insufficient evidence that deposition occurred in an intertidal, reef, or deep subtidal habitat. The presence of potential-reef building organisms that did not form a reef suggests that there were abiotic or biotic factors that contributed to the lack of reefal development. The low diversity, abundance, and density of the biotas suggest that the recovery of marine communities was slow after a long interval of clastic deposition. The presence of abundant stromatoporoids indicates that the environment they inhabited was probably a relatively warm-water habitat (Lubeseder 2008). This suggests that isolation or the lack of accommodation space, rather than latitudinal position, played a role in restricting reef community development in the Gobi-Altai terrane during the Emsian.

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