attempt to filter out those who might not have had the innate motor skills or temperament needed for the job. Those who were confident in their decision to volunteer were interviewed in FossiLab, and the majority of those then registered for the program. Twenty eight people, some new and some experienced, were trained. FossiLab is now staffed by as many as six volunteer preparators performing a variety of tasks for Paleobiology every weekday. Weekend days are starting as well. The number of weekly man-hours has more than tripled since the training. Continued, focused training on individual projects is carried on by the VP Lab staff. Eighteen hours of videotape was recorded during the training and is on course to be edited and available via DVD and online.

Poster Session IV, (Saturday)

A STUDY OF A *TROODON* EGG CONTAINING EMBRYONIC REMAINS USING EPIFLUORESCENCE MICROSCOPY AND OTHER TECHNIQUES

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A partial *Troodon* egg from the Late Cretaceous (Campanian) Judith River Formation of central Montana contains disarticulated limb bones, vertebral centrum, and a single tooth. Histological sections of a limb bone reveal six to eight layers of vascular canals, profuse vascular space, abundant osteocytes, and evidence of initial osteonal development. Histologically, the embryonic skeletal elements represent an earlier ontogenetic stage than similar bones in a *Troodon* egg from the contemporaneous Two Medicine Formation in Montana. The 1 mm-thick eggshell consists of mammillary, prismatic, and external layers. The external layer fluoresces brightly when viewed by epifluorescence and cathodoluminescence microscopy; however, this color intensity does not extend into the underlying prismatic layer, thus indicating a transition occurs between layers 2 and 3. The presence of three structural layers in this eggshell further supports the evolutionary relationship between *Troodon* and birds. Although commonly used in the study of carbonates, epifluorescence microscopy is rarely employed in the study of fossil eggs. This technique offers several advantages over cathodoluminescence analysis, including minimal sample preparation, lower cost, and greater structural definition of some features.

Technical Session VI, Thursday 3:30

THE CRETACEOUS SKELETON COAST OF ANGOLA

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Cretaceous coastal sediments of Angola present a rich and diverse fauna of marine amniotes, including turtles, mosasaurs, and plesiosaurs. The abundance of mosasaurs in particular suggests a highly productive coastal area. Angola today lies at the northern limit of the Namibian Desert, the so-called Skeleton Coast, which results from prevailing southeasterly winds of the descending limb of the southern Hadley Cell sweeping across the African coast. The Benguela upwelling and a highly productive sea are found today off the Namibian Desert coast. However, the Benguela upwelling system, based on results of DSDP studies, is said to have originated in the late Neogene and therefore cannot explain the productivity found along the length of the West African coast. The explanation is found in the northward drift of Africa through the arid climate zone, and is demonstrated by the tracing of the paleogeographic position of fossil localities through time.

Poster Session I, (Wednesday)

INVESTIGATION OF FEEDING MECHANICS IN *CHAMPSOSAURUS*: JAW ADDUCTOR CHAMBER RECONSTRUCTION AND CRANIAL FINITE ELEMENT ANALYSIS

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Champsosaurus has long been thought to have occupied a niche similar to that of gharials. Both share many piscivorous features, such as an elongate snout and needle-like teeth. *Champsosaurus* differs in the structure of the jaw adductor chamber, it being larger and surrounded by gracile temporal arches. Gharials have a smaller chamber in relation to the size of the skull and surrounded by robust temporal bones. Because no choristoderes are living, reconstructing the muscles of *Champsosaurus* done using extant phylogenetic bracketing, with lepidosaurs and crocodilians being the brackets. When the jaw musculature of *Sphenodon* was mapped on to a *Champsosaurus* skull the pterygoideus ventralis originated on an unusual position on the palate and the largest muscle is the adductor mandibulae externus medialis, which originates on the large squamosal. The force that the adductor muscles exert is calculated using the formula F = ASCA•ST, where ASCA is the actual cross-sectional area of the muscle, and ST is the specific tension of the muscle, which ranges from 15 to 24 N•cm-2. The ASCA was interpreted to be equal to the area of the opening of the adductor chamber. Calculations show that an adult *C. natator* (UALVP 47243) could exert between 1194 (ST = 15) to 1910 N (ST = 24) of force with the jaw adductor muscles. *C. lindoei* (UALVP 33928) could exert muscle forces ranging from 310 to 497 N. *Gavialis gangeticus* was calculated to have a range of muscle forces between 739 and 1182 N. *Crocodylus cataphractus* was calculated to have a range of 1498 to 2396 N. Finite element analysis indicates that *Champsosaurus* had little stress in the temporal arches, with the most compressive stress concentrated between the orbits, with the most tension on the palate below that. In crocodilians, the stress generated from a bite was found to be far more evenly spread throughout the skull. The jaw adductor muscles of *Champsosaurus* were similar to lepidosaurs rather than crocodilians, in a large *Champsosaurus* they were capable of exerting more force than a gharial, and that stress during a bite was concentrated around the orbits leaving the temporal arches with little stress.

Technical Session XIX, Saturday 1:45

PATTERNS OF HYPSODONTY IN UNGULATES SHOW THAT NEOGENE ARIDITY IN NORTH AMERICA PRECEDED THAT IN EURASIA

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Previous work has shown that the mean hypsodonty of the large herbivorous mammals in fossil communities can serve as a proxy for paleoprecipitation, and thus may illustrate changing climatic patterns through the course of the Neogene. For the Recent, mean hypsodonty alone explains 65% of global precipitation, but it performs relatively poorly for the Eurasian high latitudes, and for the Neotropics, both areas that have relatively recently (late Pleistocene) lost many of their large mammals. Mean hypsodonty maps for Eurasia show that patterns of rainfall were quite different prior to 11 million years ago, when the continent was much more humid than today, and that progressively modern rainfall distributions developed around 7 to 5 million years ago. Here we compare mean hypsodonty patterns of Eurasia with newly derived ones for North America, and show that modern patterns of aridity appeared much earlier on the North American continent. North America and Eurasia appear fairly similar in the early Miocene, with estimates of paleoprecipitation much greater than today for both continents, although North America shows slightly greater aridity, especially in the southwest regions. By the middle Miocene this aridity had spread across the Great Plains in North America, but in Eurasia such aridity is seen only in a few places at this time. The most profound change in North America is seen in the early late Miocene, when the entire continent appears moderately arid. At this same time a similar degree of aridity appears in central Asia and southern Europe, although other areas remain mesic. North America retains this pattern throughout the rest of the Neogene, with the southwestern areas tending to become somewhat even more arid over time. Although aridity continues to increase in Eurasia through the late Miocene, it does not come to match the patterns in North America until the Pliocene. These differences in predicted paleoprecipitation from faunal hypsodonty levels probably reflect differences in patterns of uplift and tectonics on the two continental masses, which in turn affected the local climate and vegetation and hence the diets of the herbivorous mammals.

Poster Session II, (Thursday)

DIVERSE TURTLE FAUNA (REPTILIA, TESTUDINES) FROM THE UPPER JURASSIC OF NORTHERN GERMANY AND ITS IMPLICATIONS FOR TURTLE PHYLOGENY

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Taxonomy of Upper Jurassic turtles is still controversial, and most taxa are difficult to compare because separated shells and isolated skulls historically have mostly been described independently. Furthermore, the majority of the so far described specimens have been united in common taxa for which the phylogenetic position is not entirely resolved yet. A phylogenetic analysis of the newly described material will contribute to a better understanding of the relationships within Jurassic turtles. The Langenberg Quarry (Kimmeridgian) near Oker, Niedersachsen (Lower Saxony basin), northern Germany, yields a rich fauna of marine and terrestrial tetrapods, mainly including theropods, sauropods, pterosaurs, crocodiles, and turtles. Most of the turtle material consists of disarticulated shell fragments but more complete specimens have also been found. A nearly complete skull from the Lower Kimmeridgian as well as a complete specimen from the Middle Kimmeridgian were discovered in 2007. The latter consisting of a carapace with the plastron partially visible between the fontanelles of the ribs and a partial skull attached. These more complete specimens as well as an additional skull from the same locality, but a different layer, were described, and morphological characters are included into the latest phylogenetic analyses. Both skulls display significant morphological differences which support an assignment to different taxa, even though they are of similar size. However, a close resemblance to the Plesiochelyidae is indicated for both skulls. The rich disarticulated shell material represents different ontogenetic stages in a range from 7 cm to nearly 50 cm carapace length, but at the moment it remains unclear if this shell material belongs to a single taxon or different taxa.