interbedded with basal sandstones. This facies was deposited in part on the remnants of a Middle to Late Jurassic volcanic arc. It is laterally equivalent to the Nooksack Group and underlying Wells Creek volcanic rocks, and correlative with strata in the Methow trough. Overall, the stratigraphic sequence and basement rocks are remarkably similar to the basal Great Valley sequence and underlying rocks in the California Coast Ranges. The western facies consists of thinly bedded to massive volcaniclastic sandstones complexly interbedded with ocean-floor (MORB) basalts, basaltic tuffs, ribbon chert, and polymict pebbly mudstone. Clastic rocks contain rare fragments of amphibolite, blueschist, and upper Paleozoic limestone in addition to voluminous volcaniclastic debris. This clastic eugeosynclinal association is a deposition unit rather than a melange formed by offscraping or accretion. In contrast to the eastern facies, basaltic rocks and pelagic cherts are distributed throughout the section and are interspersed with terrigenous clastic rocks. Coeval, lithologically comparable sequences are the Kelp Bay group (southeastern Alaska), the Pacific Rim complex (western Vancouver Island), and probably the Yolla Bolly terrane in the easternmost Franciscan. The western and eastern facies in northwestern Washington are presently separated by middle Cretaceous thrust faults.

CRADDOCK, CAMPBELL, Univ. Wisconsin, Madison, WI

Tertiary Deformation in Western Spitsbergen

During Cretaceous time, before the opening of the northernmost Atlantic Ocean, western Spitsbergen lay oppostie northeastern Greenland. With the opening of the Norwegian Greenland Sea during early Tertiary time, Spitsbergen slid past northeastern Greenland along a transform fault zone. This strike-slip displacement was accompanied by a strong transpression of the adjacent rocks, causing uplift of crustal blocks in a narrow belt along the western coast of Spitsbergen. Eastward from this coast, three structural zones can be recognized; (1) a 30-km-wide coastal zone of Hecla Hoek strata (upper Precambrian-lower Paleozoic) which was strongly deformed during the Caledonian orogeny and uplifted during early Tertiary time; (2) a 10-km-wide disturbed zone of Devonian-Cretaceous strata with some sills; tilted, folded, and faulted during early Tertiary time; and (3) an interior zone of flat-lying Tertiary sedimentary beds. Most Hecla Hoek structures are probably pre-Devonian, but a prominent westward-dipping foliation may be Tertiary in age. The beds of the disturbed zone display an impressive variety of folds and faults related to uplift, tilting, and slippage between beds; one cliff shows a sequence with large recumbent folds resting in fault contact upon an unfolded sequence. Other structures, however, are related to eastward thrusting of the massive Hecla Hoek rocks onto the younger beds. A graben in the coastal zone, with nearly horizontal Tertiary beds, probably reflects a new tectonic regime (transtension) that formed after Spitsbergen had moved clear of Greenland.

CRAWFORD, G. ALLAN, Union Oil Co. of California, Brea, CA

Allochthonous Carbonate Rocks in Toe-of-Slope Deposits (Permian, Guadalupian), Guadalupe Mountains, West Texas

Channelized allochthonous carbonate toe-of-slope deposits, equivalent to the Goat Seep Dolomite, and possibly the Getaway Bank, are well exposed along the west face of the Guadalupe Mountains. There are five rock types present: (1) fine rudite conglomerate, (2) carbonate megabreccia, (3) oolitic packstone/grainstone, (4) wavy-laminate wackestone, and (5) thin-bedded sandstone/siltstone. The rudites (~ < 1.0 m thick) appear to have been deposited by laminar debris flows, as evidenced by clasts aligned parallel to bedding, a non-erosive base, and the presence of a rigid plug. In contrast, the megabreccias (> 2 m thick) may have been deposited by turbulent debris flows, based on their erosional bases and lack of aligned clasts. The other rock types are interpreted to have been deposited by fluid density flows and turbidity flows.

The carbonate rocks in the toe-of-slope strata occur in lens-shaped deposits (0.5 km wide × 30 to 50 m deep) that are surrounded by sandstone and siltstone. The lenses are interpreted as basinward-trending channels that have been filled with shelf- and shelf-edge derived sediments deposited at the base of a carbonate buildup. The channels are typically filled with megabreccia at the base, consisting largely of shelf-edge debris, which is overlain by finer rudites and/or oolitic packstone/grainstone, consisting largely of shelf-derived debris. It is interpreted that the megabreccias were derived from large slumps or slides near the shelf-edge and that the shelf-derived sediments were later carried across the shelf-edge and were deposited in the toe-of-slope as separate, finer units.

CRESS, LELAND D., Colorado School Mines, Golden, CO (Present address: Pennzoil, Denver, CO)

Climatic and Structural Controls of Stacked Algal Lime Mud Mound Development in Oquirrh Group (Pennsylvanian and Permian), Deep Creek Mountains, Southeastern Idaho

Oquirrh Group rocks comprise the uppermost of a series of allochthons exposed in southern Idaho. The basal unit of the Oquirrh Group, the West Canyon Limestone (Atokan), is composed largely of lime mudstone and fossiliferous lime wackestone with the exception of a coarse quartzarenite and lime mudstone clast debris flow that originated from syndepositional faulting. Overlying this unit are unnamed cyclic back-mound siltstones, sandstones, cherts, and fossiliferous wackestones and packstones that thicken southward from 270 to an estimated 1,000 m of noncyclic strata of similar lithologies. Cyclic, thinly stacked algal lime mud mounds are inferred to have developed in Desmoinesian time. In Virgilian time, syndepositional faulting controlled the development of thickly stacked (700 m) algal, lime-mud mounds. To the north and west, cyclic back-mound lithofacies consist of siltstone, sandstone, chert, lime mudstone, and fossiliferous wackestone and packstone. Similar but noncyclic fore-mound lithofacies are greatly thickened southward suggesting that syndepositional faulting controlled sedimentation.

In Wolfcampian time, cyclic, stacked bryozoan algal lime mud mounds (300 m thick) developed. Thin tabular lime mud mounds developed in cyclic back-mound lithofacies. Similar fore-mound lithofacies thickened in a southerly direction. As many as 50 cycles developed in Middle Pennsylvanian to Lower Permian rocks. Eustatic sea level changes caused by late Paleozoic glaciation controlled cyclic sedimentation.

Syndepositional faulting in Atokan, Desmoinesian, and Virgilian times also had the effect of keeping the northern and eastern parts of the study area in the marine photic zone. This area may have constituted a paleohorst within the Oquirrh basin in Pennsylvanian and Permian times.

CREVELLO, P. D., J. W. PATTON, G. K. GUENNEL, Marathon Oil Co., Littleton, CO, et al

Source Rock Potential of Basinal Carbonate Muds, Bahamas