GEOLOGY OF THE NORTHERN INDEPENDENCE MOUNTAINS, NEVADA *

E.L. MILLER, R. DYER, D. HARBAUGH, J. BATESON, D. DINTER, AND THE STANFORD GEOLOGICAL SURVEY, DEPARTMENT OF GEOLOGY, STANFORD UNIVERSITY, STANFORD, CALIFORNIA 94305.

TWO DIFFERENT AGE EUGEOCLINAL ROCK SEQUENCES ARE PRESENT IN THE NORTHERN INDEPENDENCE MOUNTAINS, NEVADA. THE OLDER OF THE TWO SEQUENCES CONTAINS MOSTLY ORDOVICIAN-AGE ROCKS AND WAS MAPPED BY CHURKIN AND KAY (1967). THE YOUNGER SEQUENCE CONSISTS OF MISSISSIPPIAN AND YOUNGER (?) ROCKS OF THE SCHOONOVER FORMATION (HERE CALLED THE SCHOONOVER COMPLEX), MAPPED BY FAGAN (1962). THE RELATIONSHIP BETWEEN THESE TWO EUGEOCLINAL ROCK SEQUENCES WAS UNCLEAR. FAGAN (1962) MAPPED A PORTION OF THE BASE OF THE SCHOONOVER AS A THRUST FAULT. CHURKIN AND KAY (1967) SUGGESTED THE BASE OF THE SCHOONOVER WAS AN UNCONFORMITY. IN ORDER TO CLARIFY THESE RELATIONSHIPS, THE STANFORD SUMMER FIELD GEOLOGY CLASS SPENT FIVE WEEKS MAPPING IN BOTH THE ORDOVICIAN AND THE SCHOONOVER COMPLEX TERRANES.

WE HAVE DIVIDED THE AREA INTO FOUR MAJOR STRUCTURAL BLOCKS:

1. TIGHTLY FOLDED CAMBRIAN-AGE MIOGEOCLINAL ROCKS, PRESUMABLY PART OF THE LOWER PLATE OF THE ROBERTS MOUNTAINS ALLOCHTHON, BUT NOW IN HIGH-ANGLE FAULT CONTACT WITH THE ALLOCHTHONOUS ROCKS.
2. DEFORMED ORDOVICIAN-AGE ROCKS BELONGING TO THE ROBERTS MOUNTAINS ALLOCHTHON.
3. ROCKS THAT UNCONFORMABLY OVERLIE 1 AND 2. BOTH THE ORDOVICIAN EUGEOCLINAL ROCKS AND THE CAMBRIAN MIOGEOCLINAL ROCKS ARE UNCONFORMABLY OVERLAIN BY SEQUENCES OF PERMIAN AND/OR CARBONIFEROU

ROCKS, ALTHOUGH THESE OVERLYING SEQUENCES ARE NOT IN MAP CONTINUITY WITH EACH OTHER. THESE ARE TERMED OVERLAP ASSEMBLAGE.

4. ISOCLINALLY FOLDED ROCKS OF THE MISSISSIPPIAN AND YOUNGER(?) SCHOONOVER COMPLEX. THE SCHOONOVER COMPLEX STRUCTURALLY OVERLIES ORDOVICIAN ROCKS AND OVERLAP ASSEMBLAGE ROCKS ALONG A THRUST FAULT THAT OCCURS AT OR NEAR GREENSTONE UNITS NEAR THE BASE OF THE COMPLEX.

* THIS REPORT IS PRELIMINARY AND SUBJECT TO MODIFICATION

[redacted]

SCHOONOVER COMPLEX

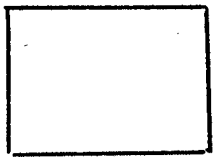
THE SCHOONOVER COMPLEX STRUCTURALLY OVERLIES CARBONIFEROUS AND PERMAIN AGE OVERLAP ASSEMBLAGE ROCKS AS WELL AS ORDOVICIAN EUGEOCLINAL ROCKS. THE SCHOONOVER COMPLEX WAS FIRST DESCRIBED BY FAGAN (1962), AND CONSISTS OF A DEEP WATER ASSEMBLAGE OF RADIOLARIAN CHERT, ARGILLITE, SILTY LIMESTONE, SANDSTONE/QUARTZITE, PEBBLE CONGLOMERATE AND MINOR LIMESTONE AND GREENSTONE/VOLCANIC UNITS. CLASTIC ROCKS WITHIN THE SCHOONOVER COMPLEX REFLECT MULTIPLE SOURCE REGIONS. MOST ARE DERIVED FROM THE EROSION OF THE ROBERTS MOUNTAINS ALLOCHTHON, AND ARE STRIKINGLY SIMILAR IN COMPOSITION TO CLASTIC ROCKS WITHIN THE TWO OVERLAP ASSEMBLAGES IN THE STUDY AREA. LITHIC (CHERT AND VOLCANIC) GREYWACKE, TUFFACEOUS CHERT, AND VOLCANICLASTIC ROCKS FORM A VOLUMETRICALLY MINOR, BUT IMPORTANT PORTION OF THE SEQUENCE, AND THEY INDICATE THE PRESENCE OF AN ANDESITIC-DACITIC SOURCE TERRANE. SILTY LIMESTONE CONSTITUTES A FAIR PORTION OF THE SCHOONOVER COMPLEX AND MAY IN IN PART OR ENTIRELY DETRITAL IN ORIGIN.

THE SCHOONOVER COMPLEX HAS BEEN DATED AT TIS BASE AS MISSISSIPPIAN (FAGAN, 1962). STRUCTURALLY HIGHER UNITS HAVE ALSO BEEN DATED AS MISSISSIPPIAN, AND YOUNGER, PENNSYLVANIAN-AGE UNITS ARE PROBABLY PRESENT AS WELL (POOLE, PERSONAL COMM.).

THE THRUST FAULT WHICH JUXTAPOSES MISSISSIPPIAN-AGE DEEP WATER ROCKS ABOVE PERMIAN-AGE SHALLOW WATER ROCKS OCCURS AT OR NEAR GREENSTONE/VOLCANIC UNTS AT THE BASE OF THE COMPLEX. ROCKS WITHIN THE SCHOONOVER COMPLEX ARE ISOCLINALLY FOLDED. AXIAL PLANES OF FOLDS STRIKE N47E AND DIP 67 NW. FOLD AXES FORM A GIRDLE WITHIN THIS PLANE. ONLY ONE FOLDING EVENT HAS AFFECTED THESE ROCKS.

THE TIME OF THRUSTING OF THE SCHOONOVER COMPLEX IS NOT WELL

CONSTRAINED IN THE MAP AREA. THRUSTING POST-DATED DEPOSITION OF LOWER PLATE PERMIAN AGE ROCKS AND PRE-DATED UNCONFORMABLY OVERLYING TERTIARY VOLCANIC ROCKS.



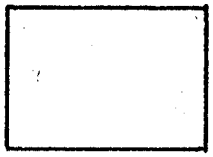
OVERLAP ASSEMBLAGE ROCKS

Along Jack Creek, on the western side of the range, Ordovician-age eugeoclinal rocks are unconformably overlain by alluvial-fluvial to shallow marine breccia and boulder conglomerate and finer-grained sedimentary rocks, derived for the most part from the erosion of the underlying rocks. These rocks have been dated as probably Carboniferous-Permian in age (Churkin and Kay, 1967), and we tentatively correlate them to post-Antler Orogeny Overlap Assemblage rocks recognized elsewhere in Nevada.

Correlation of these rocks to post-Antler Orogeny Overlap Assemblage rocks suggests that the Seetoya thrust beneath the Eugeoclinal rocks mapped by Kerr (1962) is probably equivalent to the Roberts Mountains thrust.

Along the east side of the range, Ordovician-age eugeoclinal rocks are in high angle fault contact with Cambrian -age miogeoclinal rocks that are tightly folded and unconformably overlain by calcareous and clastic rocks that have been dated as Carboniferous(?) and Permian in age (Churkin and Kay, 1967). Clastic rocks within the sequence contain quartzite and chert debris and were derived from the erosion of allochthonous eugeoclinal rocks. Small coral reef buildups within the sequence indicate that these rocks were at least in part deposited in a shallow water shelf environment.

If this sequence also forms part of an "overlap assemblage", the emplacement of the Ordovician eugeoclinal rocks must have been followed by the formation of extreme erosional relief and/or an episode of block faulting and erosion in order to expose rocks in a lower plate position to the Roberts Mountains allochthon.



ROBERTS MOUNTAINS ALLOCHTHON

DEFORMED ORDOVICIAN-AGE AND YOUNGER(?) EUGEOCLINAL ROCKS IN THE STUDY AREA CONSIST PRIMARILY OF MASSIVE ORTHOQUARTZITE INTERBEDDED WITH ARGILLITE CHERT, AND GRAPTOLITE SHALE . THESE ROCKS HAVE BEEN DATED AND CORRELATED TO THE VALMY FORMATION BY CHURKIN AND KAY (1967). SOUTH OF THE STUDY AREA, THESE ROCKS ARE ARE THRUST OVER MIOGEOCLINAL AND TRANSITIONAL ASSEMBLAGE LOWER PALEOZOIC ROCKS ALONG THE SEETOYA THRUST (KERR, 1962; CHURKIN AND KAY, 1967).

THE LACK OF DISTINCTIVE MARKER UNITS WITHIN THE ORDOVICIAN-AGE SEQUENCE MAKES IT DIFFICULT TO DETERMINE THE DETAILED STRATIGRAPHY AND STRUCTURE OF THESE ROCKS. QUARTZITE UNITS WITHIN THE SEQUENCE RANGE FROM SEVERAL CM TO MANY METERS THICK, AND ARE OFTEN 15 TO 20 M THICK. IN MOST CASES, THE QUARTZITE UNITS ARE MASSIVE AND STRUCTURELESS. THE BASE OF BEDS ARE GENERALLY FLAT OR RUMPLED IN APPEARANCE, AND DIRECTIONAL SOLE MARKS WERE OBSERVED ONLY IN A FEW LOCALITIES. THE MOST COMMON STRUCTURES WITHIN BEDS ARE GREY WISPY LAMINATIONS. POSSIBLE DISH STRUCUTES WERE SEEN IN SEVERAL PLACES. ARGILLITE RIP UP CLASTS UP TO A METER IN DIAMETER, ARE FREQUENTLY PRESENT WITHIN THE MASSIVE ORTHOQUARTZITES. OCCASIONALLY, IN AREAS OF GOOD EXPOSURE, THE TOPS OF THE QUARTZITE UNITS CAN BE SEEN TO FINE UPWARDS INTO ARGILLITE. MOST OFTEN THEY EXHIBIT SHARP TOPS. LENSES OF ORTHOQUARTZITE COBBLE CONGLOMERATE AT THE BASE OF MASSIVE QUARTZITE UNITS AND MINOR TURBIDITE UNITS WITHIN CHERT-ARGILLITE SUCCESSIONS CONSTITUTE A MINOR PORTION OF THE ORDOVICIAN-AGE SECTION.

THE STRUCTURALLY HIGHEST UNITS WITHIN THE SEQUENCE CONSIST OF

LITHIC QUARTZITE UNITS INTERBEDDED WITH CHERT AND ARGILLITE. THESE CONTAIN VARIABLE MIXTURES OF WELL-ROUNDED QUARTZ GRAINS (LIKE THOSE IN THE ORTHOQUARTZITES) AND ANGULAR FRAGMENTS OF CHERT, ARGILLITE, PHYLLITE, AND ORTHOQUARTZITE. OCCASIONAL HORIZONS WITH BRACHIOPOD MOLDS (AS YET UNDATED) ARE PRESENT IN THESE ROCKS.

GRAPTOLITE SHALES AND RADIOLARIAN CHERT WITHIN THE ORDOVICIAN SEQUENCE WERE PROBABLY DEPOSITED IN DEEP WATER. THE OCCURENCE OF ORTHOQUARTZITE INTERBEDDED WITH THESE ROCKS IS UNUSUAL, HOWEVER IT IS MOST LIKELY THAT THESE WERE DEPOSITED IN DEEP WATER AS WELL. THE CHARACTERISTICS CITED ABOVE, TOGETHER WITH THE LACK OF SHALLOW WATER STRUCTURES WITHIN THE QUARTZITES PROBABLY INDICATE DEPOSITION BY GRAIN FLOW OR DEBRIS FLOW MECHANISMS. THE SANDS COMPOSING THESE UNITS UNDOUBTEDLY ORIGINATED IN A SHALLOW WATER ENVIRONMENT BUT WERE SUBSEQUENTLY REWORKED, PROBABLY FUNNELED DOWN SUBMARINE CANYONS AND OUT ONTO THE CONTINENTAL RISE.