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MEMORANDUM FOR: Kristin Westbrook, Project Manager  
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FROM: Richard H. Berry, Consultant *RHB*

SUBJECT: ASSESSMENT OF THE BWIP MAPPING PROGRAM

INTRODUCTION

The following pages provide a preliminary assessment of the Rockwell field mapping program for BWIP. The assessment is based on handouts, personal observations, and informal presentation by the Rockwell geological staff during the field inspection of October 22-26, 1984.

ASSESSMENT OF THE CURRENT MAPPING PROGRAM

Scope Purposes: Plans and coverage of the current mapping program were reviewed earlier, during an initial phase of the mapping review (Corps of Engineers letter to NRC, September 12, 1984). Consequently, neither the program plans nor coverage of past, present, and future mapping were displayed during the recent field review. However, informal discussions indicated that current mapping by Rockwell includes the areas of Rattlesnake Mountain, Snively Basin, Yakima Ridge, and the Phase I Analog Study, all of which were visited in the course of the field inspection. The purposes presented for mapping each of these areas seem to be beyond question.

Rattlesnake Ridge, Snively Basin, and the eastern portions of Yakima Ridge each offer hope of better understanding the nature of the Cle Elum-Wallula lineament at its closest proximity to the proposed repository.

According to the local aeromagnetics (figure 4.2, RHO-BW-ST-19P), the feature is less than a mile from the southwestern corner of the repository. In addition, its 120 mile linear extent implies regional tectonic significance. Hence, it appears to be the most important single feature pertinent to both the local hydrologic regime and the structural stability of the repository. Presently, little seems to be known of its physical nature or tectonic significance. If geologic relationships necessary to adequately resolve the feature are not locally available, it appears that additional efforts would be required elsewhere.

As outlined in a handout (SD-BWI-ER-005, September 1983), the principal purpose for the Vantage study is to establish the details of the structural characteristics of a synclinal area analogous to that of the repository, but where bedrock exposure allows direct observation of pertinent features. Because of the thick sediment cover across the repository area, the definition of such detail, including the nature and density of faulting, probably will not be possible.

The five east-west road traverses which have been incorporated into the modified Phase II plans for the Vantage area appear to be particularly well suited to better understand the north northwest structures which pervade the region. Known features of this set include the Schnebley fault and its associated shears observed in the Vantage area, the numerous volcanic feeder dikes identified in the central and eastern portions of the Plateau, and various other faults of the same orientation throughout the region (Corps of Engineers, 1981, Composite Structure Map of the Columbia Plateau, 1:500,000). Other members of this set may include the fault postulated beneath the linear segment of the Columbia River in the Vantage Analog area, the "Cold Creek Barrier" adjacently west of the repository, and various other linear topographic features, possibly including the abrupt eastern terminus of Yakima Ridge.

The feeder dikes would appear to indicate that the north northwest trend involves substantial widespread crustal rupture which has been active at least throughout the long duration of volcanic activity, implying major tectonic significance. Also because of their steep dip, it may be difficult or impossible to identify such features beneath the sediment cover of Pasco Basin. Consequently, it would appear that their hydrologic properties, tectonic stability and earthquake potential must be resolved elsewhere. The five east-west road traverses of the Vantage Phase II plans will probably reveal much regarding these north northwest features. However, other areas may be better suited for defining some essential parameters, including recency of tectonic activity.

Quality of Results: Based on mapping results exhibited for the eastern end of Yakima Ridge and completed portions of the Phase I coverage of the Vantage area, the quality of mapping appears to be excellent, especially in light of the stratigraphic and structural complexities and the paucity of exposures in many places. Rattlesnake Mountain, Snively Basin and Yakima Ridge are being mapped on 1:12,000 enlargements of standard U.S.G.S. quadrangle sheets, with locational aid provided by aerial photographs. In the Vantage area, the Phase I preliminary mapping is on 1:24,000 quadrangle sheets. In all areas, stratigraphic uncertainties are resolved by applying appropriate lab techniques to field samples. These and all other mapping procedures appear to be well suited to the situation.

Most important in terms of quality of results is the high caliber of personnel who have been performing the actual field work. Each has several years of experience on the Plateau, and demonstrates a strong overall geologic expertise. In contrast with many other geologic settings, the structural and stratigraphic peculiarities of the BWIP region are such that specialized talent appears essential for dependable results.

Pertinence of Results: Although none of the current mapping is well advanced, preliminary results appear vitally important, and clearly demonstrate the value of the mapping program and the necessity for its timely completion. One important finding is that the structure of the region is more complex than prior work had suggested. This is particularly significant in the Vantage synclinal analog of the repository setting. Equally important is the difficulty in recognizing the structure even where well exposed, as exemplified by comparisons of current results with previous reconnaissance mapping. Both factors further emphasize the difficulties to be encountered in interpreting the drilling and geophysical results from beneath the thick sediment cover of the repository area.

Another important finding is the nature of the numerous faults found throughout the region, including those of the Vantage synclinal area. Apparently because of the brittleness of the basalt and the shallowness of deformation, they commonly express brecciation zones which are anomalously thick with respect to their fairly minor stratigraphic offset. Much of that brecciation is indurated and would appear to provide barriers to groundwater flow. However, substantial portions of the brecciation are poorly indurated (SD-BWI-ER-005, p. 26), and probably provide relatively high permeabilities. In either case, such brecciation seems to be critically important to understanding the groundwater regime of the repository, and the creation of any reasonable flow model. Structural details may be comparably important in terms of tectonic stability and seismicity.

#### CONCLUSIONS AND RECOMMENDATIONS

Based, in part, on the geologic aspects mentioned above, it appears that a detailed knowledge of the peculiar structural style of the repository region is largely dependent on detailed field mapping. As a result, such mapping is a vital and essential ingredient for proper planning and interpretation of on-site drilling and geophysical efforts, as well as for the assessment of the nature and magnitude of potential shortcomings of on-site exploration. Consequently, continuation of a comprehensive and detailed field mapping program appears to be an essential part of all further attempts to amply characterize the BWIP repository site.

Reportedly, only one Rockwell field person has been actively involved in mapping for the last year or more. Unlike many other geological settings, that effort will require personnel especially experienced in Plateau-type geology, people who probably are in short supply. As a result, the effort cannot be adequately accomplished in a short time by a large number of non-specialized personnel, but rather will require the few available specialists for a much longer period of time. The sooner the results of those efforts are available, the more meaningful will be the on-site drilling and geophysics. Consequently, I strongly recommend that the Rockwell mapping program be accelerated as soon as possible.