
Tour Guide

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INTRODUCTION TO THE GEOLOGY AND HYDROGEOLOGY OF THE COLUMBIA RIVER BASALT GROUP Prepared for the October 31, 2007 Columbia Basin GWMA Tour By: Terry L. Tolan, LHG, & Kevin A. Lindsey, LHG, PhD GSI Water Solutions, Inc. The flood basalt flows of the Columbia River Basalt Group (CRBG) cover more than 64,000 square miles in Washington, Oregon, and western Idaho. Throughout most of their extent, CRBG flows host aquifer systems that are utilized to supply water for a wide range of domestic, municipal, industrial, and agricultural uses. However in the past several decades, awareness of the limits and vulnerability of this groundwater resource have been the focus of much concern, debate, and study. A critical aspect to all of these discussions is the hydrogeologic characteristics and behavior of CRBG aquifer systems. A number of hydrogeologic studies of the CRBG have been conducted over the last 40 years. Despite all of this work, there still remains substantial disagreement regarding the hydraulic characteristics and hydrologic behavior of CRBG aquifer systems on both the local and regional scale. Much of this confusion and disagreement is in large part due to unfamiliarity with CRBG physical geology and underestimating its importance and the role of other geologic features on controlling CRBG aquifer systems. This handout was designed to provide a very brief introduction to geology and physical characteristics of CRBG flows and how these physical characteristics, along with secondary factors, influence and control the occurrence of groundwater within the CRBG. The information contained within this handout has been summarized from a large number of geologic and hydrogeologic studies, published papers, and abstracts. For the sake of clarity (and brevity), bibliographic citations have been omitted from this handout. However the bibliography of the geology/hydrogeology of the CRBG, which was used in the preparation of this handout, is available on the new U.S. Geological Survey/Oregon Water Resources Department "Columbia River Basalt Stratigraphy in Oregon" website at http://or.water.usgs.gov/projs_dir/crbg/. This website also contains some additional information on the general geology of the CRBG and subsurface CRBG data collected from the geologic logging of deep water supply wells in the Umatilla/Walla Walla Basins, The Dalles area, and the northern Willamette Valley. It is our hope that this handout will help promote a wider understanding of the physical characteristics and geology of the CRBG and foster a better understanding of the hydrogeology of the CRBG aquifer system. If you have any questions, please feel free to contact us at (509) 735-7135.

Stratigraphy (mappable units) of the Columbia River Basalt Group (CRBG) As this chart to the right shows, the CRBG has been divided into a host of regionally mappable units based on variations in physical, chemical, and paleomagnetic properties (N = normal polarity, R = reversed polarity, E = excursions polarity, and T = transitional polarity) - in regard to stratigraphic position (sequence) - that exist between flows and packets of flows. In the Umatilla Basin area the CRBG is represented mostly by three formations, from youngest to oldest, the Saddle Mountains, Wanapum, and Grande Ronde Basalts. These formations can further be subdivided into a number of members defined, as are the formations, on the basis of a combination of unique physical, geochemical, and paleomagnetic characteristics. These members can be, and often are, further subdivided into flow units. Relationship of sediments to the Columbia River Basalt Group (CRBG) in the Columbia Basin area During and after CRBG eruptive activity, lakes, streams, and rivers re-established themselves and deposited sediments across the Columbia Plateau. As a result we find that sediments are interfingering with, and overlies the CRBG units (indicated in red). The presence of these sediments provides a natural, mappable subdivision between those sediments intercalated with the CRBG (interbeds) and those that overlie the CRBG (suprabasalt sediments). Sediments associated with CRBG span an age range from approximately 16.5 to 5 million years ago. Sediments interbedded with the CRBG (indicated in yellow) in the Columbia Basin area are considered part of the Ellensburg Formation and are identified on the basis of which CRBG units overlie and underlie the sedimentary interbed. Sediments overlying the CRBG. Map A. Area covered of the CRBG in Oregon, The offshore extent of the not shown, but they are known more than 20 miles offshore. To view the original DOWNLOAD the Tour Guide Powerpoint Presentations and Word Document below. Tour Guide Part 201 Tour Guide Part 202 Tour Guide Part 203 Tour Guide Part 204 Tour Guide Part 205A Tour Guide Part 205B