Temporal framework for the paleoecological and -climatic reconstruction of the Pacific Northwest: Seed money for research into crucial volcanic deposits in eastern Oregon.

Abstract

Fauna and flora fossils preserved in the deposits of the John Day and Mascal Formations of eastern Oregon and exemplified by the John Day Fossil Beds National Monument provide an exceptional record for paleoeclogical and –climatic conditions as they were between 37 and 15 million years ago. Associated with deposits that hold the fossils are widespread volcanic layers (ignimbrite sheets) that can provide precise radiometric age data due to their mineralogical and post-depositional characteristics. This study proposes to use these ignimbrite sheets for establishing a regional temporal framework for placing paleoecological and –climatic events into a cohesive chronological sequence that is currently lacking on a regional basis.

Introduction

Ignimbrites sheets are volcanic deposits originating from highly explosive eruptions that form widespread (1000's of km^2) and mostly continuous layers of volcanic rocks (Fig. 1). These ignimbrites contain the most suitable minerals for precise radiometric ages for time periods in the million of years. Such ignimbrites occur in eastern Oregon throughout sedimentary and ash deposits of the larger John Day Basin which preserve a world-renowned record of paleoecological and paleoclimatic changes (see attached letter by paleontologist Ted Fremd and http://www.nps.gov/joda/index.htm). This fortunate coincidence is crucial as the different ages of the ignimbrites can provide a tight temporal framework for interpreting biological and ecological events that happened millions of years ago. This type of precise age information cannot be obtained directly from the fossil bearing deposits themselves for two reasons. Ash deposits are highly weathered while ignimbrites are not with the consequence that minerals of the ash deposits, which could have been used for dating, have broken down during this weathering process thereby losing their age information. The second reason is that the fossils themselves can only yield relative age information thus no absolute time datum. The other advantage of ignimbrites is they are continuous over wide areas compared to other volcanic rocks that have more restricted areal distributions. The original widespread distribution of ignimbrites is crucial for correlation among fossil-containing, depositional sequences that are now separated due to discontinuous deposition, coverage by younger rocks, or due to erosion that led to a complete removal of part of the deposits. Although some ignimbrites of the John Day Basin have been dated and used to establish a timeframe for paleoecological and paleoclimatic changes, such work has been focused on areas within the boundaries of the actual National Monument of the John Day Fossil Beds in eastern Oregon and only on selected deposits. As outlined in the attached letter by Dr. Ted Fremd, crucial information is lacking on the way to a cohesive paleoecological and paleoclimatic reconstruction of the Pacific Northwest that are preserved in the deposits of Eastern Oregon. This is particularly regrettable as a good understanding of past climatologically induced ecological changes is one rosetta stone in charting out how today's climatological events may impact fauna and flora in the future. This proposed study will provide critical seed money for a more comprehensive study to establish a tight temporal framework to fill this gap.