International Journal of
Geohazards and Environment
http://ijge.camdemia.ca, ijge@camdemia.ca

IJGE 2016 2(3): 131-149
Available at http://ojs.library.dal.ca/ijge

# Dating Strong Prehistoric Earthquakes and Estimating Their Recurrence Interval Applying Radiocarbon Analysis and Dendroseismological Approach – Case Study from SE Altai (Russia)

Anna Agatova[1, 2*], Roman Nepop[1, 2]
[1]Sobolev Institute of Geology and Mineralogy, 3 Koptyuga Avenue, Novosibirsk, 630090 Russia
[2]Ural Federal University, 19 Mira Street, Yekaterinburg, 620002 Russia

**Abstract**: Earthquakes are some of the most disastrous geohazards. The recurrence interval of strong earthquakes is a crucial characteristic for seismic hazard risk assessment. In this context absolute age determination of ancient earthquakes is one of the key problems. This paper presents the results of our geomorphological, paleoseismogeological, and geochronological investigations in seismically active southeastern part of Russian Altai. To specify the Holocene recurrence interval of strong earthquakes in the SE Altai we used radiocarbon and tree ring analysis. Twenty-five new radiocarbon ages were obtained for previously unknown effects of prehistoric earthquakes located near the southern fault boundary of the Chagan-Uzun massif and were reactivated during the 2003 Chuya earthquake. Results obtained argue for high regional seismicity in the second half of the Holocene and indicate the Chagan-Uzun massif to be one of the major seismogenic neotectonic structure within the SE Altai. Strong earthquakes occurred here about 600-700, 1,300-1,500, 2,400-2,700, and 3,400-3,700 and 3,800-4,200 cal. BP. Together with the previously published radiocarbon dates these data clarify the chronology of seismic events within the SE Altai. The specified recurrence interval of strong earthquakes for the SE Altai is about 400 years during the last 4,000 years. Numerous evidences of several seismic excitations were found in sediments from the largest landslide triggered by the 2003 Chuya earthquake. This argues for repeated activization of the same earthquake source zones in the SE Altai during the Holocene. Seismic activization of the fault boundaries of the Chagan-Uzun massif in the late Pleistocene-Holocene, as well as in 2003, was accompanied by its rotation counter clock-wise with the prevailing displacement along dextral strike-slip faults of NW direction. This is supported by results of our geomorphological investigations and previously unknown ground effects of the 2003 Chuya earthquake in the central part of the Chagan-Uzun massif.

**Keywords**: geohazards, paleoseismicity, radiocarbon dating, dendroseismology, recurrence interval of strong earthquakes, Holocene, SE Altai

## 1 Introduction

The evolution of paleoseismogeological studies clearly demonstrates that in order to properly understand the seismic potential of a region, and to assess the associated seismic hazard, extensive studies are necessary to take full advantage of the geological evidence of past earthquakes. The period of instrumental seismological observations is insignificant in comparison with the recurrence interval of strong earthquakes. Thus to achieve these goals the historical data are necessary. Paleoseismogeology supplements historical and instrumental records of seismicity by

* Corresponding Author: Anna Agatova, agatr@mail.ru, Tel: +7 (383) 330-8363


DOI: 10.15273/ijge.2016.03.014