
Chapter 1: Introduction

Toronto, Ontario, Canada was the host city of the 1957 meeting of the International Association of Seismology and Physics of the Earth's Interior, at which an address was given on seismological aspects of nuclear explosions. It was also at this meeting that the first public release was made of the source details of a scheduled nuclear explosion in Nevada. This explosion, code-named Rainier, took place 250 m below the Earth's surface on September 19, 1957. There have been well over 1,000 underground nuclear explosions worldwide since then; roughly half of them have taken place since the 1974 signing of the Threshold Test Ban Treaty by the U.S.A. and U.S.S.R, which bans underground nuclear testing by these two countries with yields of more than 150 kilotons. Most of these underground nuclear explosions have been weapons tests.

Verification, or more precisely, what constitutes adequate verification, has been the most contentious technical issue of the test ban debate. More than 30 years have elapsed since the 1958 conference of experts in Geneva — the first significant East-West meeting to discuss the technical aspects of seismic verification — during which time considerable progress has been made in the field of forensic seismology. Nevertheless, the world today is still without a comprehensive test ban treaty (CTBT), nor is it within unobstructed sight of such a treaty. One reason for the failure to bring about a CTBT continues to be concerns over adequate verification of compliance with test ban treaties.

The purpose of this report is to summarize the highlights of seismic verification research undertaken at the University of Toronto on behalf of the Verification Research Program of External Affairs and International Trade Canada. The results reported here are drawn partly from recently published scientific articles, partly from scientific articles which are in press as of July 1991, and partly from unpublished findings connected with our ongoing research activities. Being intended for a broad spectrum of readership, this report is written with fewer technical terminologies than one typically encounters in formal scientific journal articles.

The report begins with a general description of some basic concepts involved in forensic seismology in order to familiarize readers with some essential background information. Later chapters explain the University of Toronto team's research objectives and accomplishments since the middle of the 1980s. This work has benefitted greatly from close co-operation with seismic experts from the Geological Survey of Canada.