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## DATA REPORT FOR SEISMIC EXPLOSION EXPERIMENT AT LANDERS IN 1994 USING PASSCAL INSTRUMENTS

Submitted By

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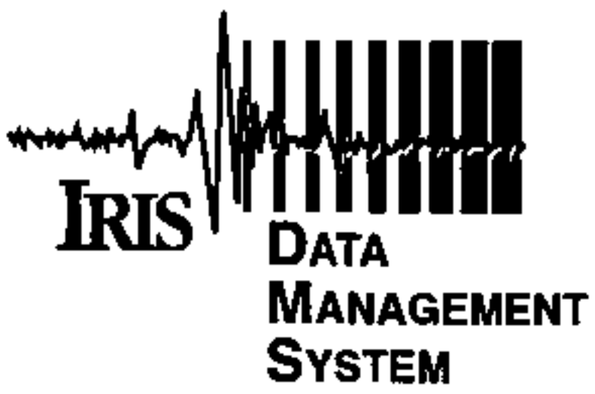
**PASSCAL Data Report 96-007**

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## *** PASSCAL DATA REPORT ***

## ABSTRACT

This report describes the distribution to the IRIS Data Management Center of data from the explosion experiment at Landers, California, collected by 80 PASSCAL 3-channel REFTEK instruments in November of 1994. This experiment is a part of work for the research project "Study of the healing of the fault zone ruptured in the 1992 Landers, California earthquake by monitoring fault-zone trapped waves", which is funded by NSF Grant EAR-9404762. Because this project is still on-going until 1997, a brief discussion of the data formats on the data tape is included here. We will release the more details of the data in the future.

Project Summary

We propose to study the postseismic healing of the fault zone ruptured in the M7.4 Landers earthquake of 1992 by monitoring propagation characteristics of fault zone trapped waves using portable REFTEK instruments. In our previous experiment, we obtained clear evidence for seismic guided waves trapped within the fault zone of the Landers earthquake. Based on trapped mode data, we resolved a low velocity (Vs~2.0 km/s), low Q (~30-50) core layer (fault gouge or break-down zone) with a width of ~180 m along the rupture plane. This layer extends from the surface to a depth of at least 10 km in the seismogenic zone. We also found that the width of this layer varies vertically and laterally along the fault zone, and it becomes very narrow at the fault bend. Observations and simulation of fault zone trapped waves show that the amplitudes and frequency contents of these waves are very sensitive to the velocity structure and properties of the fault zone. Therefore, the subsurface fault variability in space and time can be detected through monitoring minor changes in amplitude and dispersion characteristics of fault zone trapped waves.

We propose to carry out this study in a three-year period. During each year, we shall deploy 30 REFTEK units along lines perpendicular to the fault trace at two recording sites. The length of the deployment time in each year depends on the number of recorded events. We need 20-30 appropriate events for the systematic analysis of fault zone trapped modes during each recording period.

We also propose to test the excitation of fault zone trapped modes using active sources. We plan to detonate explosions in shot-holes drilled

within and outside the fault zone. We shall compare characteristics of guided waves from natural events with those excited by active sources. If results are satisfactory, we may use active sources in the future. This new fault zone imaging method may also be applied to other major faults in California where the level of seismicity is low.

Results from this study should help us to advance our understanding of fault zone structure, rheology and constitutive relations, the transition from quasistatic nucleation to dynamic rupture, and the models and mechanisms for earthquake recurrence.

Data Collection:

In collaboration with the USGS and IRIS, we conducted an active seismic experiment at Landers, California in November of 1994, to record fault- zone guided waves excited by explosions detonated along the Landers fault zone ruptured during the M7.4 earthquake of 1992. Four shots were detonated in holes at a depth of 30-50 meters using 2000, 750, 500, and 300 pounds of chemical emulsions, respectively. Three shots were located on or close to the fault trace at a distance of 1 km, 5 km and 16 km from the epicenter of the Landers mainshock of 1992 while one shot was located 3 km west of the fault zone. The origin times of four explosions are at: 04:00, 04:02, 09:00 and 09:02 on Julian Day R307 (at local times: 08:00 pm, 08:02 pm, 09:00 pm and 09:02 pm on November 2, 1994).

We deployed 80 PASSCAL REFTEK 72A-02 DAS units with 200 Mb hard disks along three ~3 km-long lines perpendicular across the fault trace at sites located 11 km north, 7 km north and 2 km south of the mainshock epicenter, respectively. Positions of stations measured by

internal GPS are showed in the REFTEK log files included on the DATA TAPE submitted to the IRIS Data Management Center.

The instrument parameters were down-loaded to the REFTEK units are shown in Table 1.

**Table 1. Instrument Parameters Used in the Experiment**

| Parameter | Description |
|---|---|
| Trigger mode | continue |
| Recording channels | 1 - 3 |
| Sample rate | 250 samples/s |
| Preamplifier | 32 |
| Record length per file | 120 s |
| Starting time | 2 s before origin of explosion |
| Data streams | 01 & 02 switch alternatively every other 2 minutes |

We used EXBYTE tape drive to dump the data from the instrument internal 200 Mb hard disks to the 8 mm tapes, and then transfer to the Sun station at USC. The total 123.5 Mbyte data are store in the sub-directories, R307.01 and R307.02, on the DATA TAPE.

The data format is SEGY created by the IRIS/PASSCAL software ref2segy. All data files are copied from Sun station to 8 mm tape as TAR

format. The user can copy data files to their own Sun station hard disk using the command "tar xvf /dev/nrst0".

Acknowledgments:

This experiment was carried out by Yong-Gang Li and Keiiti Aki of University of Southern California. The PASSCAL Instrument Center at Stanford provided considerable support. This project was supported by NSF Grant EAR-9404762. We also ask that any publications resulting from the use of this data set property acknowledge the source of the data and the extensive efforts of the scientist who collected it.