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## DEEP BOREHOLE TENSOR STRAIN MONITORING, NORTHERN CALIFORNIA

### FINAL TECHNICAL REPORT

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### TECHNICAL ABSTRACT

Five borehole tensor strain instruments situated along the San Andreas Fault in Northern California and the Hayward Fault in San Francisco Bay provide both archive quality data, and automatically processed near-real time information for use by the geophysical research community. Long term changes of strain rate have continued to present at San Juan Bautista since the October 1998 slow earthquake sequence. Four further episodic strain/creep events have been observed there during 2001/2002. At Parkfield, a series of strain/creep episodes have been observed, including propagating events with propagation rates of approximately 1 km per day. A significant shift in shear strain accumulation rate at Parkfield was observed in 1998 and has continued to date. Long term changes in strain rate at Chabot have been observed in 1997 and 1999.

Data from the Gladwin Tensor Strainmeters has been instrumental in the ongoing proposals for a Plate Boundary Observatory, and significant effort in our project is now centred on assisting this process.

### OBJECTIVES

This project continued during FY2001 a program of *maintenance* and *analysis* of deep borehole Gladwin Tensor Strain (GTS) instrumentation, which was initiated with two sites (Pinon Flat and San Juan Bautista) in late 1983. It was expanded by three sites (Eades, Donalee and Frolich) installed in the Parkfield area during December of 1986, and by two sites (Chabot and Garin) deployed in the San Francisco Bay region in 1992. The instruments consist of a three component plane strain module operating at strain sensitivity of  $10^{-10}$  and support data logging systems. As deployed to date, they provide data sampling at 30 minute intervals for transmission via satellite for permanent archive purposes. The instruments are unique in the program in that they provide continuous tensor strain data of high quality and sensitivity not achievable by any other instrumentation. Data are made available in near real time in the USGS Menlo Park computer system. These data supplement long baseline survey and GPS data, and permit real time monitoring for short term strain phenomena. The Garin site was decommissioned in 1998.

The **immediate objectives** of the project were

- Maintenance of uphole system integrity at 5 U.S. sites in northern California, with repair or production of replacement uphole electronics if necessary.
- Manual preparation of raw instrument data for permanent archive.