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**LAMONT-DOHERTY GEOLOGICAL OBSERVATORY
OF COLUMBIA UNIVERSITY**

PALISADES, NEW YORK

(NASA-CR-149155) RESURVEY OF SITE STABILITY QUADRILATERALS, OTAY MOUNTAIN AND QUINCY, CALIFORNIA Supplementary Report (Lamont-Doherty Geological Observatory) 8 p HC A02/MF A01	N77-26728 Unclas CSCL 08E G3/46 35475
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RESURVEY OF SITE STABILITY QUADRILATERALS
OTAY MOUNTAIN AND QUINCY, CALIFORNIA

Supplementary Report

July 1977

C. H. Scholz

Prepared for the

U. S. National Aeronautics and Space Administration
under grant no. NGR 33-008-146



Resurvey of Site Stability Quadrilaterals,
Otay Mountain and Quincy, California

C. H. Scholz

Summary

In 1972 trilateration quadrilaterals were established across the Melones fault near Quincy, California, and across a fault on Otay Mountain, near San Diego. These two faults are near the laser-satellite ranging sites in the SAFE experiment. The quadrilaterals were resurveyed in 1976 to determine if any motion had occurred on these faults that might significantly disturb the long-range measurements. The results indicate that no significant tectonic motion occurred during that interval of time.

Introduction

The San Andreas Fault Experiment (SAFE) is an attempt to measure the change in length of a 1000 km baseline extending from Quincy, California, in the north, about 200 km east of the San Andreas fault, to Otay Mountain, near San Diego, California, about 100 km west of the fault. The method employed is laser to satellite ranging from the two endpoints of the baseline.

One possible source of error in these measurements might arise from site instability due to tectonic motion, either seismic or aseismic, on faults close to the laser-satellite ranging sites. In order to safeguard against this form of error, local seismicity studies were done at the sites in 1972 and triangulation quadrilaterals were installed across the nearest faults considered on geologic grounds to be active. A description of the 1972 field work, including a discussion of the local seismicity and geology, is given in an earlier report (Dutch, 1972).

In July 1976 the quadrilaterals were resurveyed in order to determine if any motion had taken place in the preceding four years. The methods employed have been described earlier (Dutch, 1972).

Quincy Quadrilateral

The Quincy quadrilateral straddles the Melones fault zone some 12 km south of the laser tracking site and about 2 km west of the calibration target on Claremont Peak.

The survey figure is in the form of a braced quadrilateral (Figure 1). All four benchmarks installed in 1972 were found to be in good condition in 1976.

The results of the resurvey are shown in Figure 1 and Table 1. Uncertainties quoted are two standard deviations of the theoretical uncertainty.

The results show no significant motion on the lines 1-2, 1-3, and 2-3. The lines to BM 4 all show similar shortening in the order of 2 cm which is just above the level of significance. The shortening of these three

lines, however, is not consistent with motion of the fault since it occurs on a line (4-3) which does not cross the fault and it does not appear on the other two fault-crossing lines 1-3 and 2-3. It is interpreted as indicating a local movement of BM 4 to the NE. BM 4 is located at the edge of a NE facing cliff and this local motion may indicate an instability of this BM, with motion towards the cliff face.

Otay Mountain quadrilateral

The Otay Mountain quadrilateral is located 5 km east of the Otay Mountain laser tracking site. The figure was composed of 5 benchmarks. Four of the BM's were found in good condition in 1976, the fifth having been disturbed by local mining activity.

The results of the resurvey are shown in Figure 2 and listed in Table 2. These results are similar to those obtained at Quincy. No significant motion was observed on lines 2-3 and BM 1962 - 3. Nearly 5 cm of convergence was observed on the fault-crossing lines 2-1 and 3-1, but a similar convergence was also observed on the line BM 1962 - 1 which does not cross the fault. We attribute the convergence of these lines to instability of BM 1, and not to motion on the fault. BM 1 is located on the E side of a steep hill, and downhill creep of that BM would be consistent with the shortening of all lines emanating from that BM.

References

Dutch, S., Initial Results of Site Stability for San Andreas Fault Motion Studies, Annual Report, NASA Grant NGR 33-008-146, 1972.

TABLE 1

Results of resurvey of the Quincy Quadrilateral, 1976

Line	Length, 1972 (M)	Length, 1976 (M)	ΔL (M)	Strain (10^{-5})
1 - 2	498.329	498.325	$-.004 \pm .012$	-0.8
1 - 3	1084.064	1084.060	$-.004 \pm .014$	-0.4
2 - 3	795.434	795.424	$-.010 \pm .013$	-1.2
1 - 4	1066.105	1066.086	$-.019 \pm .014$	-1.8
2 - 4	1192.977	1192.960	$-.017 \pm .014$	-1.4
3 - 4	895.318	895.093	$-.025 \pm .015$	-2.8

TABLE 2

Results of resurvey of the Otay Mountain Quadrilateral

Line	Length, 1972 (M)	Length, 1976 (M)	ΔL (M)	Strain (10^{-5})
2-3	747.063	747.046	$-.017 \pm .013$	-2.3
BM 1962 - 3	1439.873	1439.869	$-.004 \pm .015$	-0.3
BM 1962 - 1	568.262	568.212	$-.050 \pm .012$	-8.8
2-1	1276.952	1276.902	$-.050 \pm .015$	-3.9
3-1	1721.960	1721.918	$-.042 \pm .016$	-2.4

CLAREMONT PK. - QUINCY

1" = 200 meters

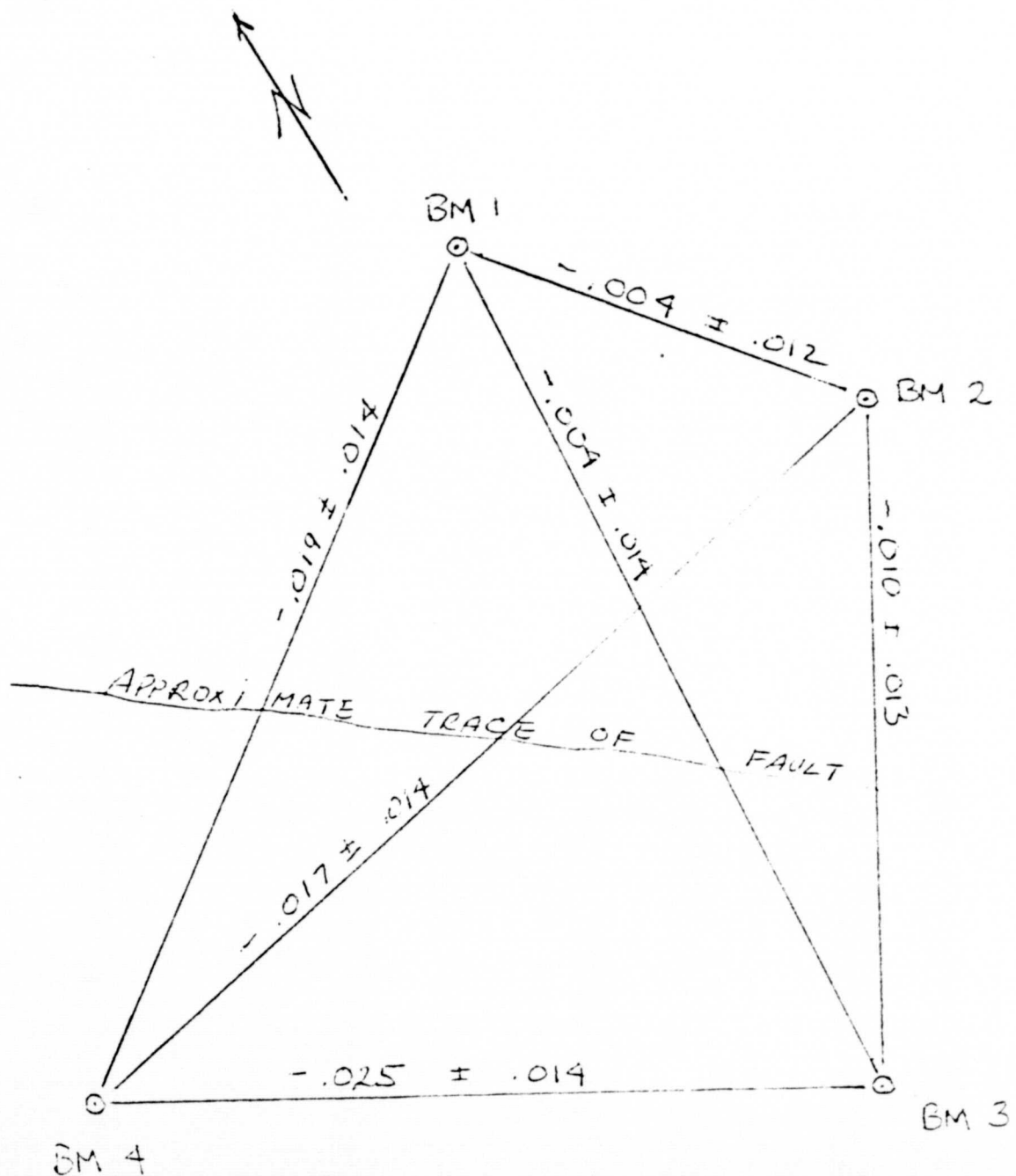


FIG. 1

CLAY MTN.

1" = 300 METERS

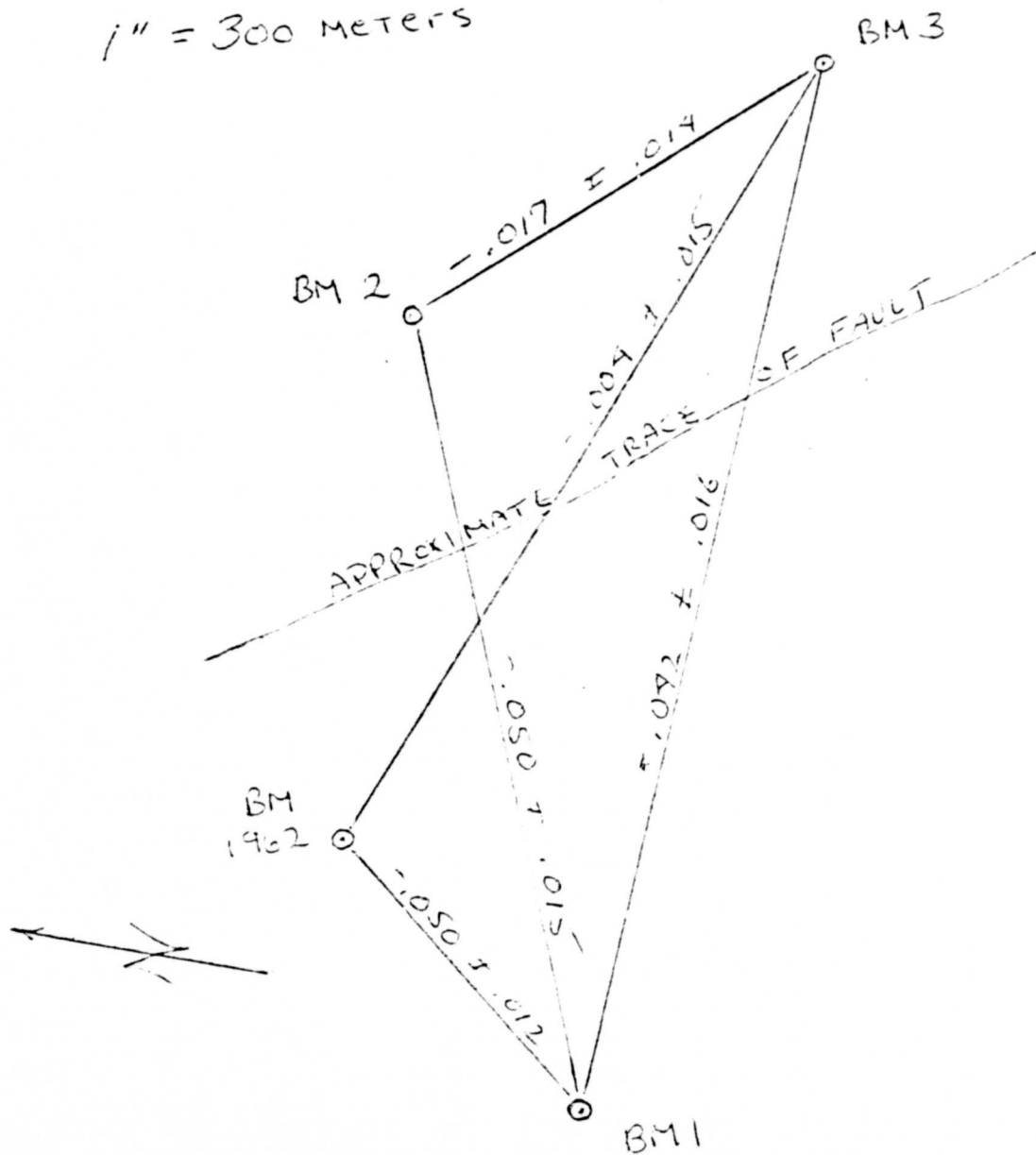


FIG. 2