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INSTALLATION OF A CRACK GAUGE TO MONITOR MOVEMENTS ON A MAJOR ACTIVE FAULT IN THE GARGANO PROMONTORY, ITALY

CONTENTS

ABSTRACT

A first survey for monitoring active tectonic movements on a significant active fault with known seismic activations in the Gargano promontory, Italy, was organized in August 2001. The fault is evident in the terrain as a scarp with an outcropping limestone fault plane that can be traced well as a scar at a length of several kilometers into the interior of the promontory. Several points suitable to be instrumented with TM71 crack gauge were selected on it, and local conditions investigated.

KEYWORDS: Mechanical interference, three-dimensional displacement, active fault

1. INTRODUCTION

Crack Gauge TM71 works on the principal of mechanical interference, moiré. Displacements are indicated by interference patterns of optical grids (KOSTÁK, 1991). Due to this principle, which completely avoids any electrical transmission means, the gauge displays an extremely large long-term stability, and infallible performance under hard outdoor conditions. It means particularly that values registered during periods of decades can be well compared. It provides three-dimensional results, *i.e.* displacement vectors in two perpendicular planes supplemented with angular deviations. Sensitivity of the system is 0,05 to 0,0125 mm in all the three space co-ordinates of displacement, and 3,2 $.10^{-4}$ rad in angular deviations of the two planes. Having experience with its performance in field use where environmental conditions are fully involved, one can assume to obtain results with the accuracy of 0,03 mm.

The gauge (Fig. 1) has a capacity to register displacements trends as low as 10^{-2} mm/year in all the three Cartesian co-ordinates. The instrument is permanently fixed to the rock, protected by a locked steel cover, being designed to survive severe outdoor conditions, as well as standard seismic effects.

In this paper we show two Crack Gauge TM71 installations along the Mattinata fault (PICCARDI L. & MORATTI G. 2002 and references therein) in the Gargano promontory (southern Italy). This project, carried out under the auspicious of the COST (European Co-operation in the Field of Scientific and Technical Research)-Action 625 "3-D Monitoring of Active Tectonic Structures", is the results of a cooperation among researchers from the Institute of Rock Structure and Mechanics, the Department of Physical Geography and Geoecology, of Prague, the CNR-Institute of Geosciences and Earth Resources (Florence) and the University of Camerino (Macerata).

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2. GARGANO MONITORING SITES

One of the paleoseismic trenches (BORRE *et alii*, 2003) opened near the village of Mattinata to a depth of several meters revealed a breccia zone, adjacent to the limestone fault plane. It was considered that movements indicated in the breccia zone would not be affected by possible secondary consolidation processes in the sediments found near the toe of the plane and, therefore, that such movements would be representative of the tectonic activity. Therefore, one crack gauge TM71 was installed to bridge over this breccia zone by anchoring into it, and put to operation (site No 1). The gauge would work as a 3-D displacement indicator able to indicate not only opening but even shear movements in the zone.

However, even the sediments in a wider zone adjacent to the fault in front of the breccia zone, were suspected to suffer active tectonic displacements. Therefore, a long vertical steel structure suitable to indicate possible vertical movements was stabilised into the bottom of the trench that was open to considerable depth in the trench. Therefore, the structure buried later in the trench by ground fill had been designed as a deep stabilisation for levelling into a depth of about 5 m.

To check the results obtainable in the trench profile, site No 1, investigations were made to find other suitable measurement points in the area. Since the fault is exposed along several km of length, the investigation was successful, and several points were found. Finally, a second point was selected lying about 1 km farther towards the sea shore in the same Mattinata area (site No 2). Here, fault planes of the same tectonic structure were found at several places (Fig. 2) and the most favorable one in a cellar cut to the slope inside a country house. The place is situated in an underground room, a small cave originally, found behind the vineyard press hall of this country house in the SW end of Mattinata village. The cave-room is opened at a length of 6 m, to a high of 2,5 m and to a depth of 6,10 m, cut into the massif bedrock. The structural planes of the fault are visible on both sides.

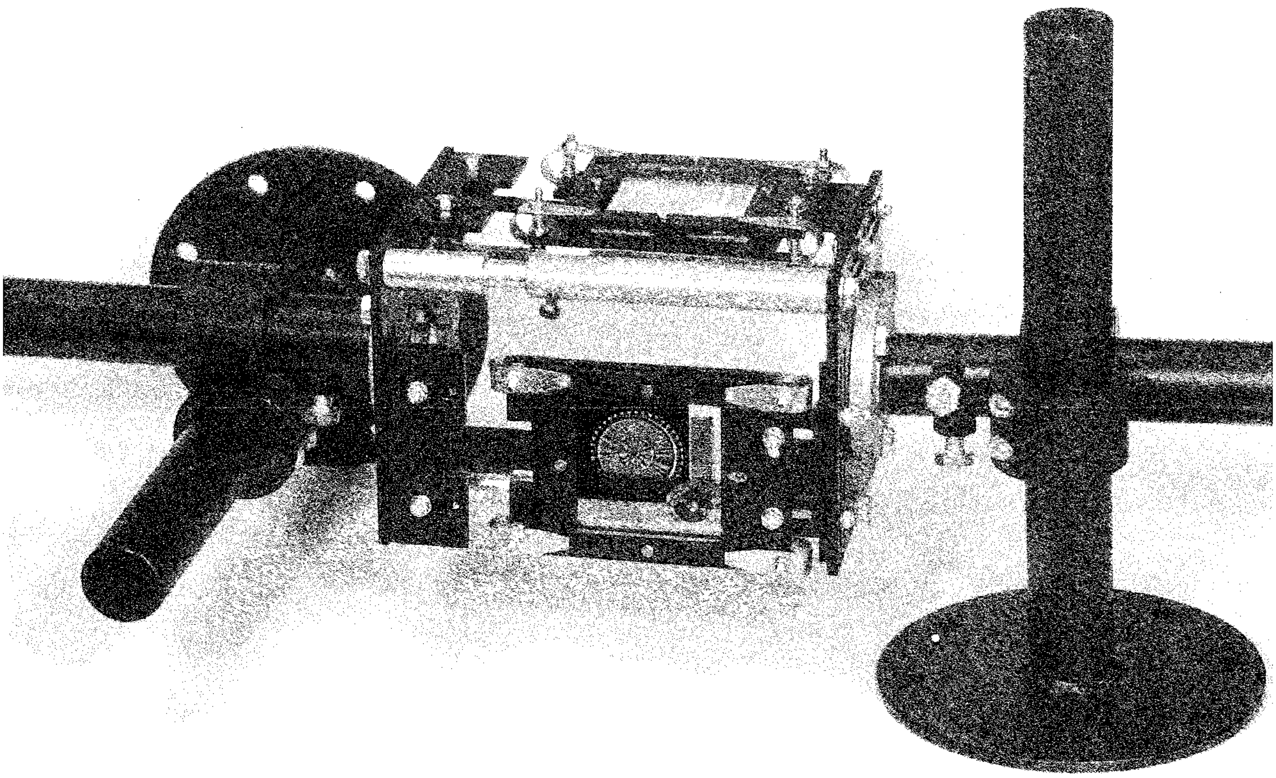

Fig. 1 - The gauge TM71 works on the principal of mechanical interference in all the three Cartesian co-ordinates.

In the western wall of the cave, the fault is represented by a plane dipping by 70° to N, connected with a breccia zone about 0,75 m thick. It is separated from Quaternary sediments by a plane dipping 75° to N. The wall makes possible to observe also some details of the fault zone deformation. The massif displays open vertical cracks connected with sub-horizontal crushed zones several cm thick. This indicates development of downslope horizontal shifts in the zone adjacent to the main fault plane. Vertical cracks are open by 2 to 5 cm. One can assume that this fracturing could have developed not very far from the surface of the terrain.

It was decided that the gauging at this second place should include the breccia zone with both the side fault planes, so that the bridging would connect the competent limestone block of the massif with the conglomerate block of the overlying deposits.

A crack gauge was then installed checking a zone across two shift planes well exposed in the W side wall of the cellar. One arm of the gauge bridge is fixed into a borehole, the other one is anchored into a wall with two short holders.

Either in the open or in the cellar, the gauges were covered with locked steel boxes to prevent possible interference of inquisitive people. Thus, two measurement sites were established in the Mattinata area and put into operation.

Fig. 2 - Fault plane near Mattinata, at installation site No 2.

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