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ENLIGHTEN THE TRIASSIC GEOLOGICAL SETTING FAVORABLE TO LARGE GYPSUM DISSOLUTION-RELATED COLLAPSES THROUGH GEOPHYSICS

Case study of the Peyrui collapse (SE France)

28th European Meeting of Environmental and Engineering Geophysics (n°100)

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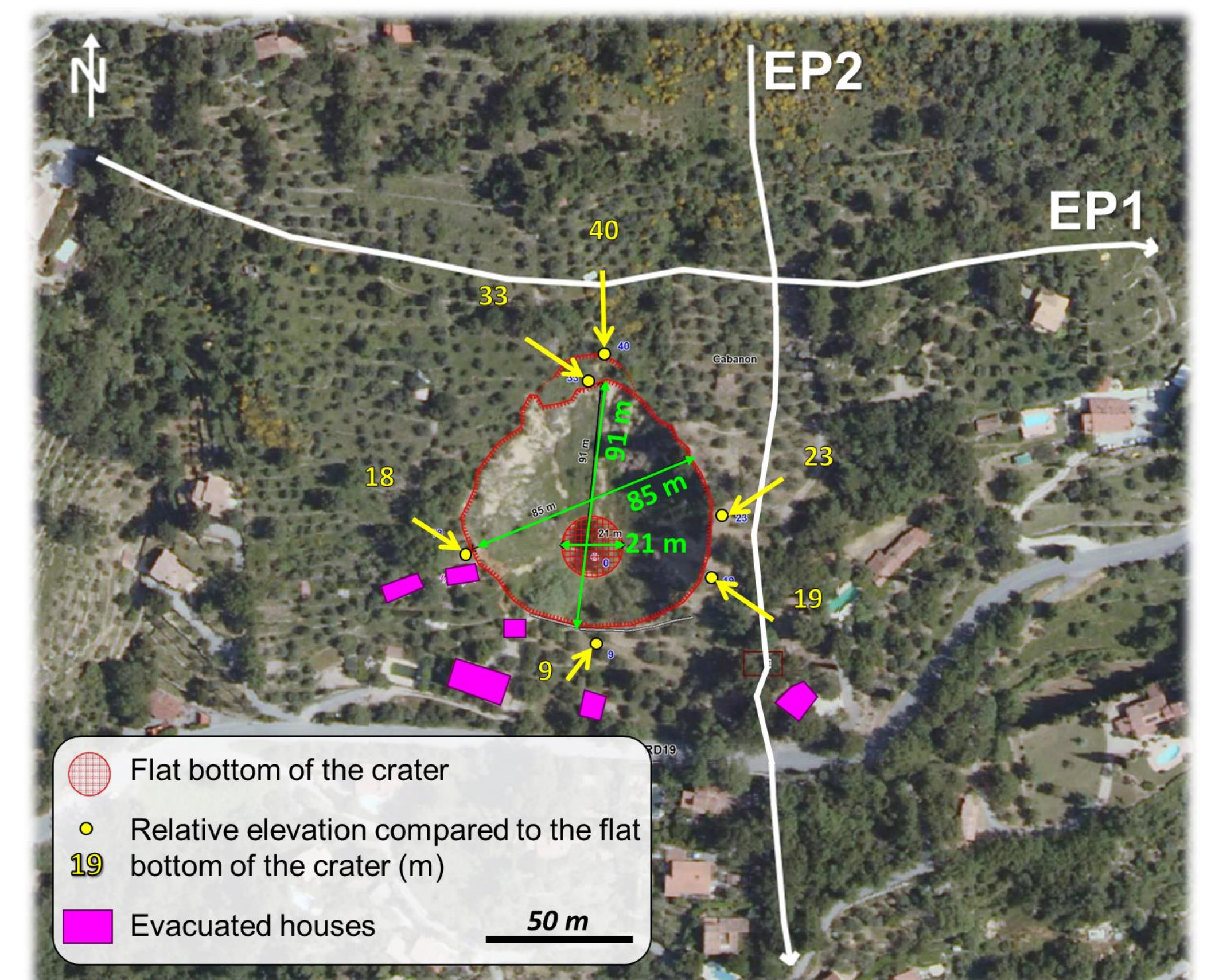
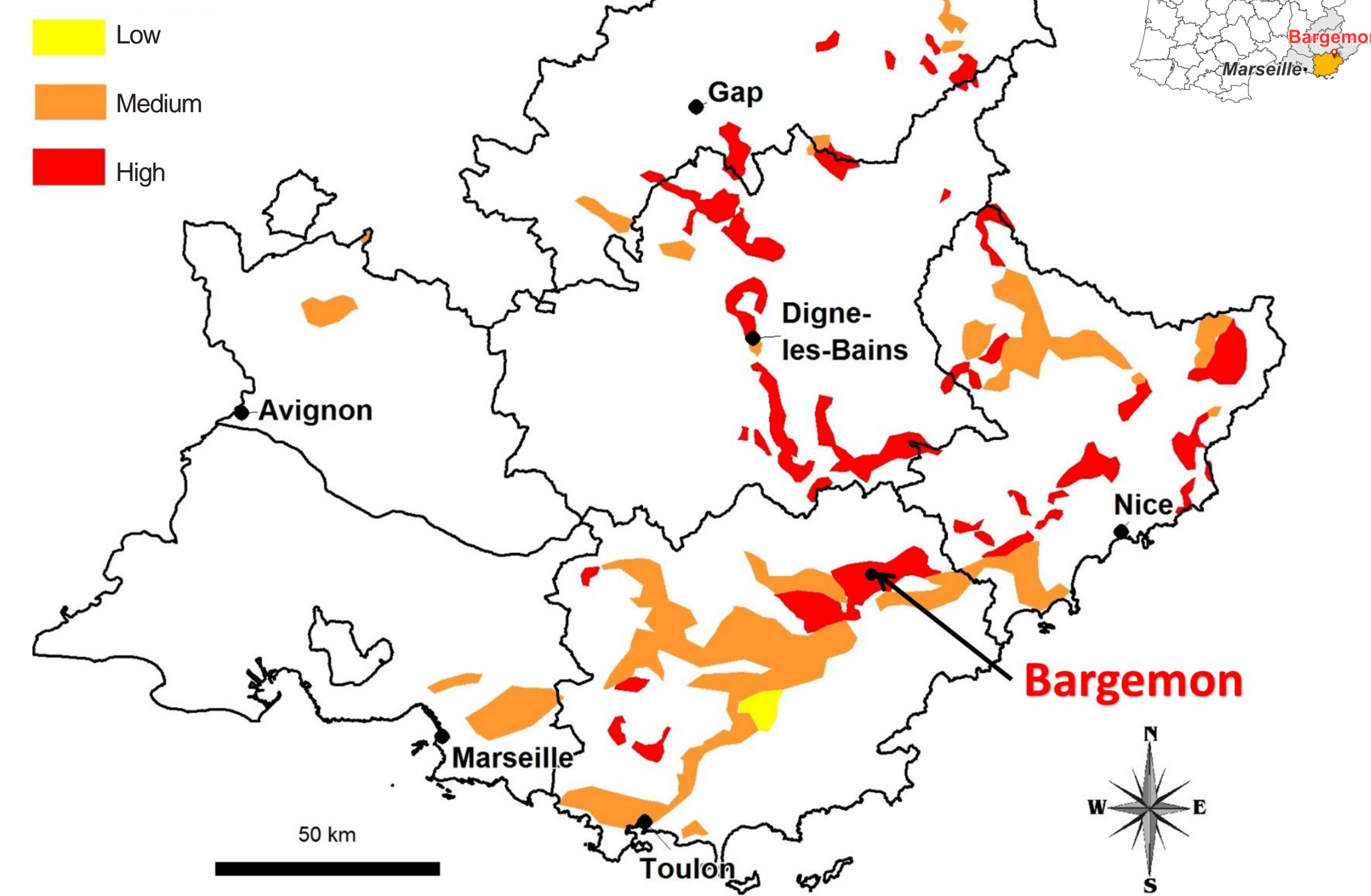
INTRODUCTION

Risk related to gypsum dissolution strongly affects the South East region of France (Fig. 1). This phenomenon may produce large superficial collapses like the Peyrui one, occurred in 1992 in a residential area of the village of Bargemon (Fig. 2).

The gypsum belongs to chaotic Triassic series and occurs either as massive bodies or mixed with various lithologies like clays. Moreover, these series are intensively deformed by the post-deposition alpine orogenic cycle.

The location and geometry of gypsum formations remain thus poorly known and constitute a major challenge for risk management.

> Fig. 1 - Susceptibility to gypsum-related landslides and collapses (BRGM/RP-60896-FR¹)



> Fig. 2 - Aerial plan view of the Peyrui collapse (EP = Electrical Profile)

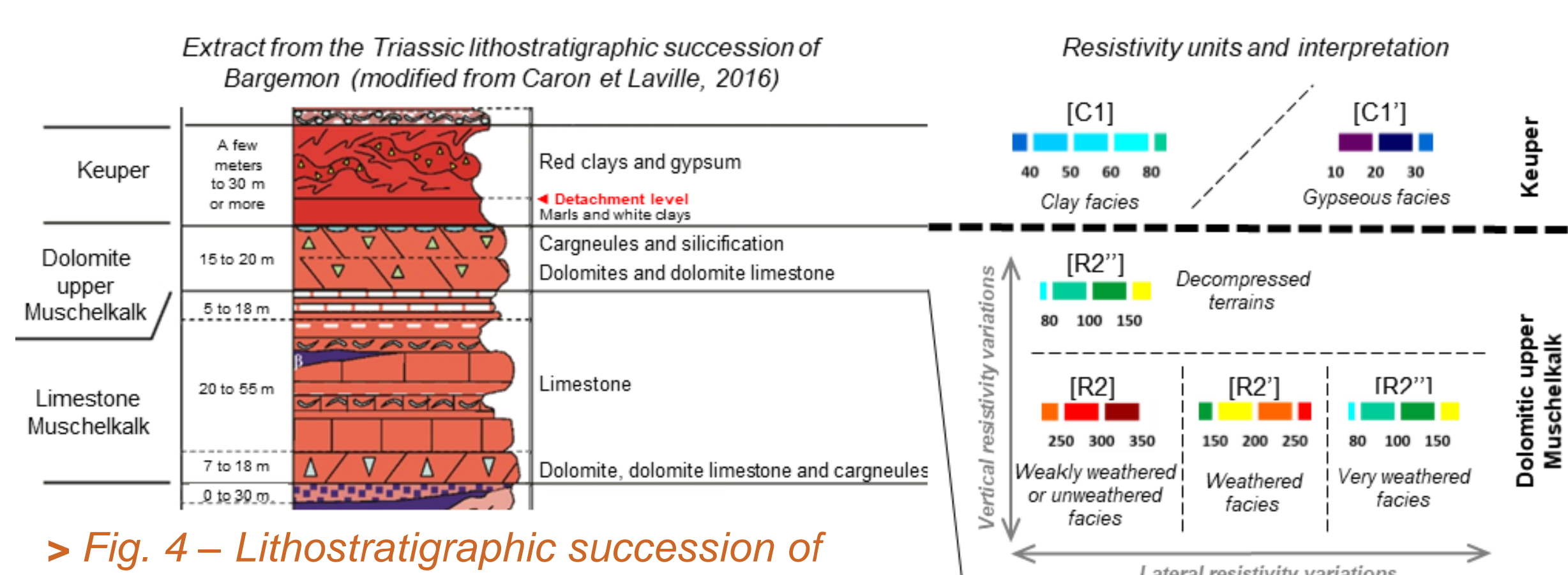
OBJECTIVES & METHODOLOGY

Our study is part of an interdisciplinary scientific program aiming at analyzing the phenomenon of gypsum dissolution in the area of Bargemon and proposing risk management solutions adapted to the local context².

Among all the methods implemented, we used geophysics through the ERT* method to constrain the local geological context of the Peyrui collapse. We realized two perpendicular profiles around the collapse (white lines on Fig. 2). We used an electrode spacing of 5 m and Wenner-Schlumberger reciprocal array for acquisitions. The inversion, realized with RES2DINV software includes topographic data.

INTERPRETATION & DISCUSSION

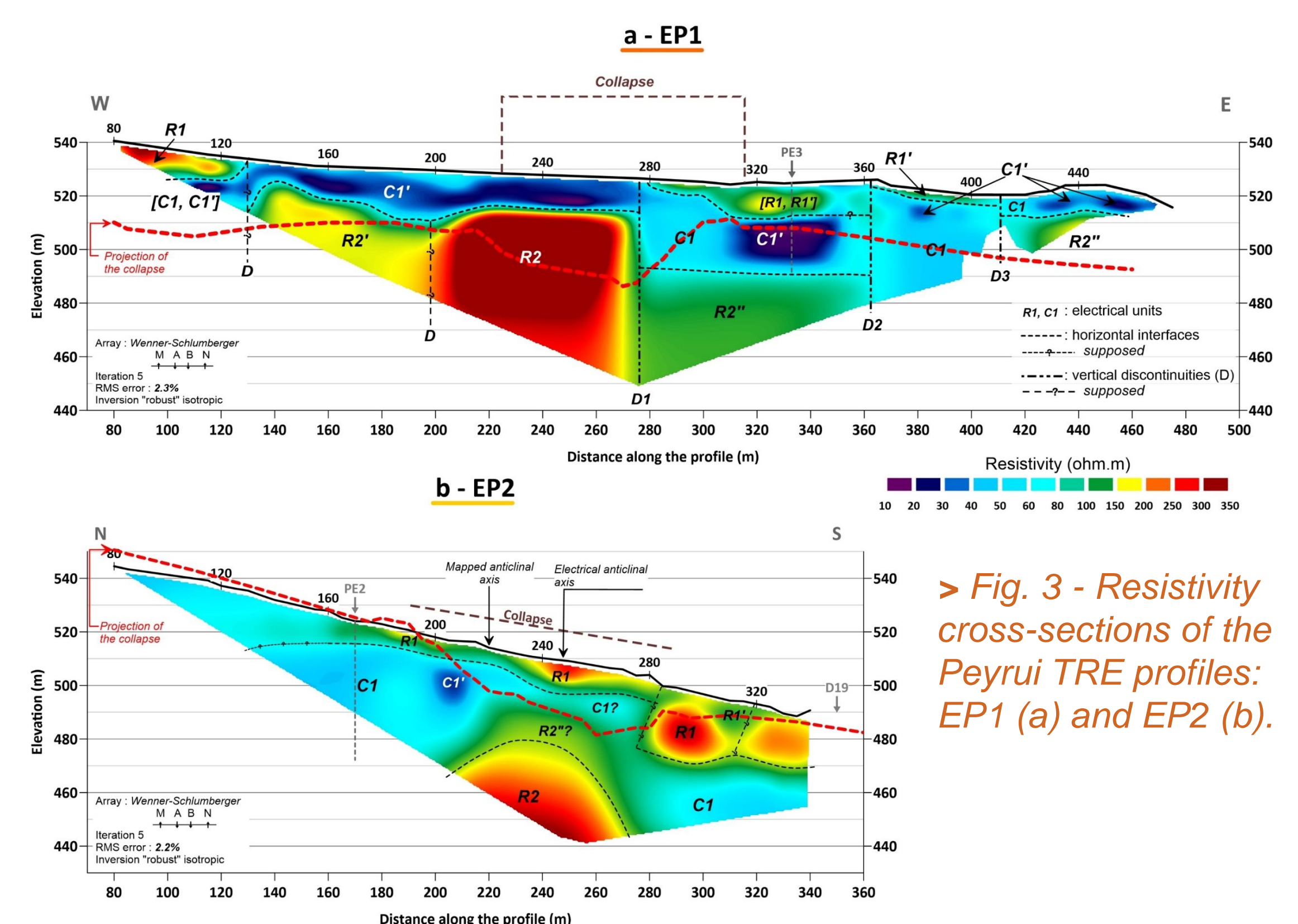
Based on detailed geological information^{2,3,4,5}, we propose a lithostratigraphic interpretation of the resistivity units (Fig. 4). We associate the conductive units to the clayey and gypseous Keuper formations and the resistive ones to the underlying Upper Muschelkalk dolomitic terrains. We interpret the resistivity variations observed within each units as due to variable weathering conditions. We interpret the vertical discontinuities as faults or supposed faults.



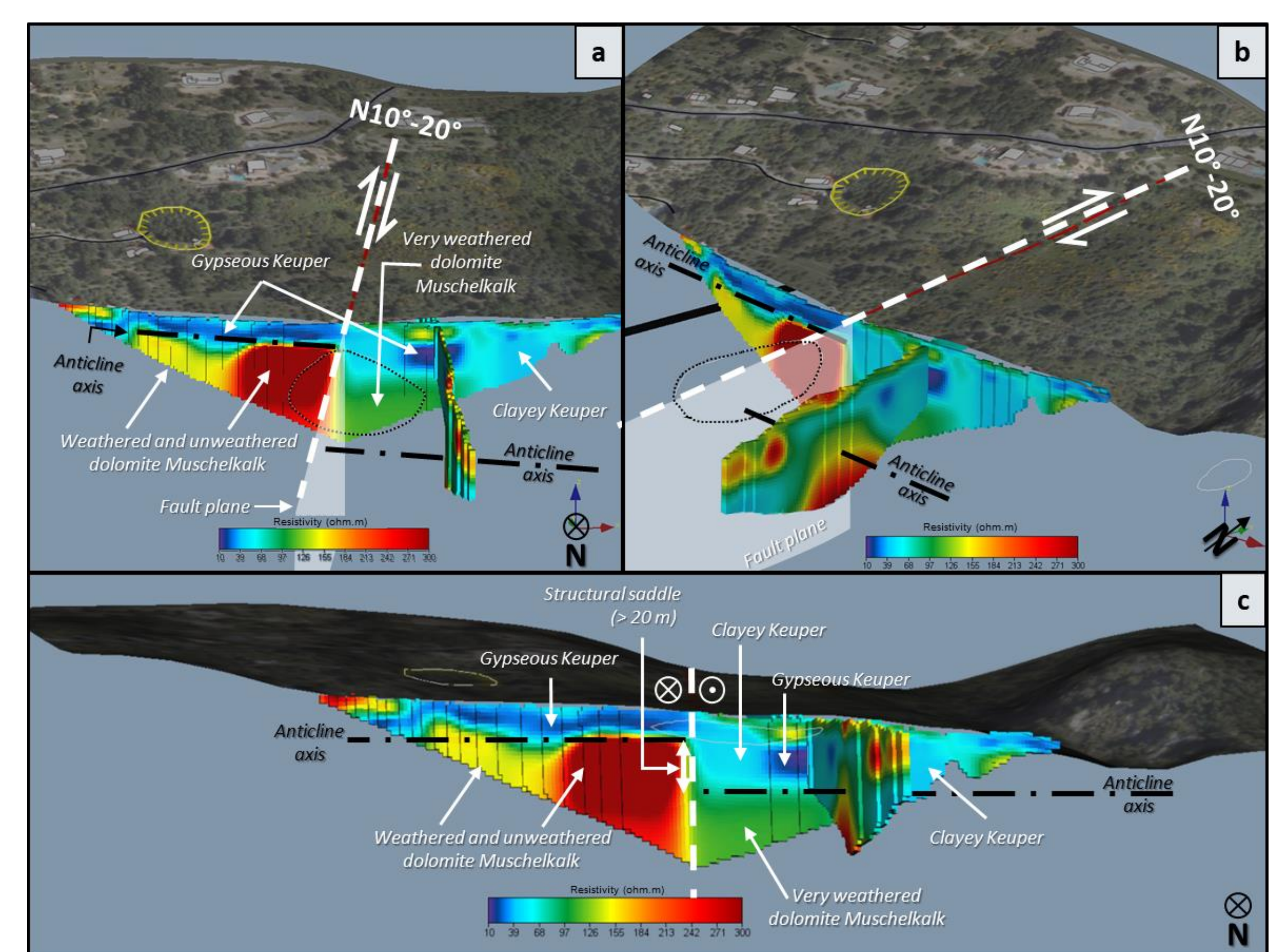
> Fig. 4 - Lithostratigraphic succession of Bargemon⁶ (left) compared to the electrical units observed and their interpretation (right).

The 3-D representation of these results offers a more precise view of the interpreted geoelectrical structures (Fig. 5). An anticline fold oriented N110° (materialized by R2) characterizes the Peyrui area. A normal fault (D1), facing east, intersects this anticline. Its orientation is supposed N10°-20° (known regional and local fault directions in this area). These results also show a dextral strike-slip and a vertical throw along the D1 discontinuity of at least 20 m (easterly downthrow). The presence of this fold could lead to an accumulation of Keuper formations (C) on its northern flank. This interpretation supports and clarifies the conclusion of Potherat (1997), who already proposed a structural origin of the collapse. Two recent core drillings close to the studied area confirmed the presence of gypsum associated with clays at the base of the Keuper formations.

RESULTS



> Fig. 3 - Resistivity cross-sections of the Peyrui TRE profiles: EP1 (a) and EP2 (b).



> Fig. 5 - 3-D representation of the interpreted resistivity cross sections around the Peyrui collapse.

CONCLUSION

Our ERT results confirm and clarify the geological and structural setting of the Peyrui area highlighting the favourable context of both gypsum accumulation (anticline fold) and water infiltration (faults). Although the mechanisms triggering the collapse, including the role of water, remain to be clarified, these results constitute a major step for risk management purposes. Through this case study, we clearly highlight that the ERT imaging is a key tool for mapping areas prone to collapse formation.

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