PhD thesis project on

"ANALYSIS OF THE GEOMETRIC, KINEMATIC AND DYNAMIC RELATIONSHIPS BETWEEN ACTIVE DEFORMATION AND QUATERNARY FAULTING ALONG POORLY-INVESTIGATED- AND POTENTIALLY SEISMOGENIC STRUCTURES IN KEY AREAS OF THE CENTRAL APENNINES (ITALY)"

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Central Apennines are among the most seismically active areas of the Italian territory. Seismological data, both historical (*Rovida et al., 2019*) and instrumental (*Valoroso et al., 2013, Chiaraluce et al., 2017*) acquired during recent seismic crises, provide significant proof of how the (well-known) W-dipping normal fault systems are responsible for most of the energy release, through earthquakes of even high magnitudes (L'Aquila, 2009, Mw 6.3, Norcia 2016, Mw 6.5 - *Scognamiglio et al., 2006*). Long-term geological-structural data (*Ferrarini et al., 2015; Lavecchia et al., 2017*), as well as geodetic observations encompassing coseismic *(Cheloni et al., 2017; Lavecchia et al., 2016; Castaldo et al., 2018)* and inter-seismic *(Carafa et al., 2020; Esposito et al., 2020)* time windows, agree in most cases on a direct link between the observed deformation and the late Quaternary-Holocene activity of the hitherto known seismogenic structures *(DISS Working Group, 2018)*; the latter associated to deformation rates within the range 1-2 mm/y (*Faure Walker et al., 2021; Carafa et al. 2022; Lavecchia et al., 2022* and references therein).

Nonetheless, recent studies which compare decadal time series of geodetic data with known historical seismicity and outcropping extensional structures, have also pointed out critical areas (e.g., along the outer extensional alignment in the Abruzzo-Molise Apennines) which exhibit inconsistencies in terms of the relationships between the observable deformation and geological/seismological record *(D'Agostino, 2014; Carafa et al., 2020).* These areas have been (or are neighbouring to) the *locus* of energetic historical earthquakes (e.g., 1805, Mw 6.7; 1984, Mw 5.9) but exhibit, in instrumental times, noticeable seismic gaps *(Chiarabba et al., 2005; Iside Working Group, 2007).* Such evidence could derive from a lack of information on the late Quaternary tectonics (and associated deformation rates) on poorly-investigated structures, often located in marginal sectors of the well-known extensional fault zones, as recently pointed out for the Norcia 2016 seismic sequence *(Ferrarini et al., 2021b*).

Constraining the Late Quaternary activity of poorly-known extensional structures and characterising their geometric-kinematic attitude is relevant for estimating maximum expected magnitudes and possible recurrence times, the latter representing the primary input for a more reliable assessment of the seismic hazard. From this perspective, the hazard models complementary to the seismic catalogue and anchored on robust geological and geodetic estimates are still largely unexplored.

The research related to this PhD project aims to delve into these subjects and boost the knowledge of the seismotectonic framework of extensional key areas in central Italy (only partially surveyed and signalled in recent geologic cartography – *https://www.isprambiente.gov.it/Media/carg/*).
The PhD student will be asked to focus on:

1) identification of late Quaternary activity on poorly-known structures in the central Apennines with a specific interest in the outer limit of the extensional belt, by using classical structural-geological survey methodologies implemented with digital mapping *(Cirillo. 2020);* fault geometric- and kinematic characterization;

2) integration of the previous methodologies with morphotectonic and quantitative geomorphologic analyses (*Kirby and Whipple, 2012; Royden and Perron, 2013; Ferrarini et al., 2021a,b*);

1) by exploiting, where possible, the availability (or the new acquisition) of high-resolution topographic data (as in *Civico et al., 2016; Bello et al., 2021);*

2) probabilistic estimation of the deformation rates (and associated uncertainties) based on the late Quaternary offsets of geologic and geomorphic markers on fault scarps (among the others, *Papanikolaou et al., 2007; Ferrarini et al., 2017; Boncio et al., 2021; Carafa et al. 2022);*

Possible opportunities for more-in-depth analyses could include aspects concerning:

a) kinematic analysis and stress field inversion of structural-seismological data framed in the regional stress-strain field *(Ferrarini et al.,2015; Cirillo et al., 2021)*;
b) 3D-model building of the seismogenic sources and testing of the geometric consistency with available seismologic data for the study areas (*Lavecchia et al., 2016, 2017; Castaldo et al., 2018).*

The PhD project will develop in the frame of a collaboration between UdA and INGV. The student's workplace will be at UdA, in Chieti, but tight cooperation with INGV supervisor and his staff is expected. A research stay (6 to 12 months) at a foreign research Institution/University is expected and considered mandatory.

We encourage the application of students who manifest a strong attitude in the field survey but who is also open to acquiring and/or improving skills with numerical approaches in geosciences (e.g. Matlab coding).

For more details on the call, recruitment procedures and deadlines, please visit the online site of the 'School of Advanced Studies' of UdA at

https://www.scuolasuperiore.unich.it/bandi/bando-di-concorso-lammissione-al-dottorato-di-ricerca-xxxviii-ciclo-aa-20222023

and download (for foreign students) the English version of the forms (*'bando_inglese_xxxviii.pdf', 'schede_inglese_xxxviii.pdf');*

or, visit also

https://en.unich.it/teaching/postgraduate-courses/scuola-superiore-g-dannunzio-school-advanced-studies

Whoever may be interested in the call feel free to ask for information to
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