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ABSTRACT BOOK

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«Geosciences for the environment,
natural hazards and cultural heritage»

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ABSTRACT INDEX

Plenary lectures	1
Session S1. Biota evolution, biomineralization and responses of ecosystems to environmental perturbations: from local to global, from short- to long-term.....	6
Session S2. Deciphering ancient paleoenvironmental perturbations and their impact on the marine ecosystems.....	22
Session S3. Marine geohazards on the continental margins of Italy	49
Session S4. The role of Italian scientists and educators in the International Ocean and Continental Drilling Programs: major achievements and new perspective.....	64
Session S5. Onshore and offshore Quaternary sedimentary processes and sequences in the Mediterranean regions	80
Session S6. The dynamics of sedimentary processes in coastal areas.....	92
Session S7. From analogue to digital geological mapping: opportunities and risks in the use of new tools	103
Session S8. Tectonic and sedimentation relationships in Mediterranean basins and belts. A tribute to Fabio Lentini.....	130
Session S9. Faulting and folding across the scales. How, where, and why the lithosphere deforms	161
Session S10. The role of shear zones in the tectono-metamorphic evolution of the lithosphere: insights from microfabric to mountain belt structures.....	181
Session S11. Tectono-metamorphic processes from micro-scale to plate margins: Geological, Geophysical and Petrological approaches in unravelling the evolution of metamorphic terrains in collisional belts.	210
Session S12. Georesources and Energy for the XXI Century.....	238
Session S13. Outcrop analogues in exploration and production.....	269
Session S14. Integrated studies of recent and active deformations onland and offshore	280
Session S15. Tectonic and geodynamic control on large earthquakes and complex earthquake sequences: case studies from Italy and not only.....	301
Session S16. Mediterranean subduction zones: from deep mantle to shallow structure and volcanism.....	325
Session S17. Geodynamic evolution between the Variscan and Alpine orogeneses: clues from mantle features and magmatic events	342
Session S18. The nature of the crust-mantle transition and its effects on the regional tectonic and magmatic evolution.....	355
Session S19. Melt/fluid-rock interaction and migration from the mantle to the surface.....	370
Session S20. Magma genesis and transport	405
Session S21. Linking deep and surface processes: advances in volcanology from a multidisciplinary perspective.....	435

Session S22. Volcano Hazard Monitoring	456
Session S23. Minerals at non-ambient conditions: A Snapshot of the Earth and other planetary bodies.....	467
Session S24. Geomaterials: Nature, properties and technology	490
Session S25. Puzzle crystallography of inorganic structures. A tribute to Fiorenzo Mazzi	509
Session S26. Zeolites and porous materials: Unravelling the relations between crystal-chemistry, stability, structure and properties	522
Session S27. Environmental and medical mineralogy: from molecular to macro scale processes	535
Session S28. Mineralogy, waste management and environmental pollution.....	549
Session S29. Environmental pollution related to Naturally Occurring Asbestos (NOA) in serpentinites and other geo-matrices	570
Session S30. Geosciences for Cultural Heritage.....	592
Session S31. Mining sites: from industrial heritage to cultural heritage	642
Session S32. Cave and karst studies: from ancient to modern processes	658
Session S33. The contribute of Hydrogeology and Geochemistry in the study and management of the water resources	679
Session S34. Monitoring of deformation of structures and ground surface displacements.....	708
Session S35. Landslides: monitoring, hazard and impact on society and cultural heritage	724
Session S36. Landscape and Landforms: geoheritage in urban and natural areas.....	738
Session S37. Geoparks and geosites: tools for knowledge and protection of geological heritage	756
Session S38. History of geosciences and Geoethics: the right way for social responsibility.....	774
Session S39. Fifty years after the Belice's Earthquake. Considerations on geological, geophysical, geochemical, territorial and social aspects of this earthquake and its heritage in the connections between the Italian society and seismic catastrophes.....	790
Session S40. The role of abiotic and biotic soil components, environmental materials and factors, and physical evidence in criminal investigations, environmental crimes, and legal system.....	805
Session S41. Planetary evolution: insights from geological studies, meteorite analyses and terrestrial analogues	820
Session S42. Geosciences at school 2018: geoscience and society	845
Authors' index.....	880

Can a simple lherzolithic mantle source explain the geochemical variation of Etnean magmas through time?

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The petrological features of the mantle beneath Mt. Etna is a controversial topic. The lack of erupted primary magmas and mantle xenoliths prevent any direct or indirect evidence of its nature and melting or metasomatic processes. The proximity of Mt. Etna to the Ionian slab and the time-related evolution of its magmatic products introduce further difficulties. On the contrary the nearby Hyblean Plateau provide large amount of mantle xenoliths and primitive products. A petrological comparison highlights several similarities similarity between the two districts, paving the way to the hypothesis that a similar mantle source could be responsible for the generation of both Etnean and Hyblean magmatisms. A detailed mass balance calculation allowed to reconstruct Mt. Etna primary magmas from the initial tholeiitic episode to the post-1971 (nowadays) stage. This simulation consisted of a backward fractionation process, in which olivine and clinopyroxene in progressive equilibrium were added to the least evolved compositions until the mantle equilibrium condition was reached (Mg# 68 of the melt, Fo_{88} in olivine). A second step was then performed to reconstruct the fertile mantle source, using mineral compositions of the Hyblean mantle xenoliths, plus amphibole from Antarctica. According to our simulation, a homogeneous lherzolithic mantle melted at various degree from 10 to 19% is able to reproduce the entire range of Etnean lavas, including the post-1971 products. In our modelling, the K and LILE enrichment of post-1971 magmas can be simply related to the variation of the amphibole and phlogopite melting proportions, whose stability is in turn linked to the activity of H_2O and CO_2 of the system. A geodynamic model for the evolution of this portion of the Eastern Sicily is also taken into account to explain the fairly homogeneous composition of the Etnean magmas, indirectly reinforcing our petrological reasoning.