Main course information	
Academic subject	Evolutionary Paleoecology
Degree course	Science of Nature and Environment
Classe di laurea	LM-60&LM75
ECTS credits (CFU)	6
Compulsory attendance	Strongly recommended
Teaching language	Italian
Accademic Year	2019/2020

Teacher information	
Name & SURNAME	Maria Marino
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Tel.	0805443454 - 3397429003
Tutorial time/day	Monday 13-17, Thuesday 15-17, Palazzo di Scienze detta Terra, University Campus

Details	Study area	SSD code	Type of class
	Earth Science	GEO01	Lecture, workshop, field exercise

Teaching schedule	Year	Semester
	II	I

Mode of Didactic supply	CFU/ECTS	Lessons (hours)	CFU/ECTS lab	Lab hours	CFU/ECTS tutorial/workshop	Tutorial/workshop hours	CFU/ECTS field trip	Field trip Hours
	5	40	0,5	7,5	0	0	0,5	10

Time management	Total hours	Teaching hours	Self-study hours
	150	57.5	92.5

Academic Calendar	First lesson	Final lesson
	1 ottobre 2019	10 gennaio 2020

Syllabus	
Course entry requirements	Geologic Time Scale, Plate tectonics
Expected learning outcomes (according to Dublin Descriptors)	
Knowledge and understanding	The student has to know all topics developed during the semester in order to understand evolution of Earth's terrestrial and marine ecosystems through the Cambrian - Recent time by scrutinizing the most important Life evolutionary steps documented in the fossil record. The knowledge of main physical modifications of Earth through geologic time and the comprehension of relationships among all the components of our planet including marine and terrestrial Biota represent the most important issue of the teaching. The taught class is the main didactic tool to acquire this knowledge.
Applying knowledge and understanding	The student has to improve its ability to connect the modifications of physical paleoenvironmens with Life evolution during the Phanerozoic. He must to recognize the evolutionary processes, which drove the most important changes of terrestrial and marine organisms during the different climate phases, diverse paleogeographic and geological settings characterizing the past 600 Ma. Such abilities are acquired through

	taught class and class discussion on paleoecological and paleoenvironmental key topics concerning crucial changes of Earth's history.
Making informed judgements and choices	The student has to be able to: critically argue and discuss the meaning of the fossils for the reconstruction of Earth's history and past ecosystems; interpret the evolutionary innovations of Life and their relations with past paleoenvironments. These abilities are improved during class discussion of paleobiological problems.
Communicating knowledge and understanding	Acquisition of scientific glossary to carefully describe concepts on the past ecosystems evolution by means of specific paleontological terminology. The student is stimulated to work and discuss together with other colleagues during class teaching in order to improve the communication skills.
Ability to continue learning	Acquisition of capability to obtain additional scientific information and integration with different disciplines. Ability to recognize the main evolutionary phases of biodiversity changes and the relations between biotic and abiotic factors, which acted through time. Skill to provide deeper knowledge on some paleontological topics of crucial interest by means of personal bibliographic research.

Sylabus	
Course content	**General introduction on the course teaching** 5 CFU/ECTS of oral teaching, 0,5 CFU/ECTS class exercises, 0,5 CFU/ECTS field exercise Main topics Basic elements of Paleoecology and Paleobiogeography. Evolution of marine and terrestrial ecosystems through Phanerozoic by examining the main biological changes provided by fossil record. **Paleozoic** Paleogeography and Climate from Cambrian to Permian. Cambrian Radiation. Lagerstatten of Burgess Shales, Chengjiang, Hunsruck, Rhynie, Mazon Creek, Karoo. Marine invertebrates. First vertebrates, evolution from fish to amphibious and reptiles. First plants. Failure of Carboniferous forests. Changes at the end of Paleozoic and Permian mass extinction. **Mesozoic** Paleogeography and Climate from Trias to Cretaceous. Increase of biodiversity. Lagerstatten of Holzmaden Shale, Morrison, Jehol. Marine invertebrates. Rudists, Ammonoids. Marine vertebrates, first avial reptiles. First dinosaurs, their evolution and "extinction". First Mammalia. Dinosauria-Birds. *Archaeopteryx* and other new findings on dinosaur-bird transition. Vegetation, radiation of angiosperms, co-evolution of insects. Phytoplankton evolution **Cenozoic** Paleogeography and Climate. Paleocene-Eocene Thermal maximum. Antarctic glaciation (Eocene-Oligocene). Lagerstatten of Grube Messel, Bolca. The big benthic foraminifera and new planktonic foraminifera. Radiation of mammal fauna. Gigant birds. Equid and climate evolution. Messinian salinity crisis. Panama Isthmus closure. The Gulf Current. Thermohaline circulation, Arctic ice sheet and biotic consequence in marine and terrestrial flora and fauna. **Quaternary** Paleogeography and Climate. Calcareous plankton and climate changes at orbital and sub-orbital scale (Heinrich and D-O events). Extinction of mega-fauna. Main changes of mollusc fauna in Mediterranean Sea. **Class exercises** Study of samples with different invertebrate fossil content based on macroscopic and microscopic analyses. Paleoecological indices, cluster analysis, PCA. Basic spectral analysis. **Field activity** Field location is chosen year by year to improve paleontological methods of investigation or to visit paleontological site/museum.
Course books/Bibliography	Palaeoecology: Ecosystems, environments and Evolution. Brenchley P.J. and Harper D.A.T., Chapman & Hall Editors (available online). Cause of Quaternary Megafauna extinction by Marianne Lehnert (available online) Evolution of fossil ecosystems. Selden P. & Nudds J., II Edition, 2012. ISBN: 987-1-84076-160-3

	(available online) The first Vertebrate, oceans of the Paleozoic Era. Holmes T. 2008. ISBN ISBN 978-0-8160-59584 (available online) Other scientific papers from online literature.
Notes	
Teaching methods	Lecture; Inquiry-based learning; Flipped classroom. Students are stimulated to develop ability for self-evaluation through discussion-debate during lecture and class exercises concerning crucial topics related to the themes of program.
Assessment methods (indicate at least the type written, oral, other)	Oral
Evaluation criteria	**Knowledge and understanding** The student has to demonstrate to know all the themes of the course. This is necessary to achieve a positive evaluation. **Ability to apply knowledge and understanding** The student has to discuss carefully the complex relationships between abiotic and biotic factors, which controlled the Life evolution. This is necessary to achieve a positive evaluation. **Autonomy of judgment** The student has to show ability to discuss evolutionary problematics by connecting information from many integrated disciplines such as geology, botanic, ecology, zoology. This is necessary to obtain a very positive evaluation. **Communication skills** A very positive evaluation is based on the student skill concerning good and appropriate scientific terminology and clear exposition of complex concepts. **Learning skill** The student has to document its ability to acquire independent advanced knowledge and critical thinking during discussion of paleontological themes. This may provide an excellent evaluation.
Other information	