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# NAVARINO ENVIRONMENTAL OBSERVATORY

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NEO Management

Thursday, 20 August 2015

## NEO NEA #17 (April - June, 2015)

NEO stands for Navarino Environmental Observatory. But NEO in Greek (νέο) means news as well and NEA is its plural. So this is our news!

### Foreword

*Last time I visited NEO, I attended the Café NEO that this time took place in Kalamata. Café Neo is a science café, initiated and organized by our Station Manager Giorgos Maneas, and that takes place at different cities/villages around Peloponnese. Every time a researcher is invited to speak science with people visiting the café. This time the topic was our marine environment. Dr. Vangelis Papathanassiou, Research Director, Hellenic Center of Marine Research talked for around 20 minutes about the threats and challenges that the Mediterranean Sea faces and will face in the future. Afterwards people were welcome to pose questions. I was amazed to see the great number of people of all ages that came and listened and that took part in the questioning and discussion that went on enthusiastically for almost 2 hours! It was a fantastic experience! And it is much thanks to the partnership that NEO is made of, with the mixture of influences from the science community and the private sector – with deep roots in the region of Peloponnese – that makes the outreach and communication of science natural and easier and what it normally is. This extended communication between academics and the local community, raising the awareness of global change, climate change and local-regional-global interconnections - is one high-light of NEO! But there are many many more! And in this issue of NEONEA you will find some examples!*

*Happy Reading!*

*Karin and Giorgos*



**Figure:** Five years of frontline research and education on climate change in the Mediterranean region

## Activities

### Research

- **Atmospheric group visit**

Tabea Hennig and Zahra Hamzavi from Stockholm University together with Nikos Kalivitis from the University of Crete visited NEO and Methoni atmospheric laboratory in order to conduct maintenance work and re-install DMPS (Differential Mobility Particle Sizer) and APS (Aerodynamic Particle Sizer). NEO atmospheric station is fully operational again.

- **Rescued by NEO ...**

NEO researchers, Alasdair Skelton and Uwe Ring have been on Sifnos this April, collecting blueschist facies rocks in an effort to learn more about carbon fluxes during formation of the mountains of Greece. On Sifnos, rocks contain a permanent record of leakage of deep sourced carbon to Earth surface. A fossil carbon pathway was found on the eastern shore of Sifnos and samples have been collected for analysis in Stockholm. Another part of this study is to find when metamorphism and carbon release occurred. Dating of radiogenic isotopes will be used in this part of the study.

Skelton and Ring returned to Athens via Milos, which is an emerging and formerly active seafloor volcano. Fossil hydrothermal systems, banded iron formations and voluminous deposits of volcanic ash can be seen on Milos. Departing from Milos airport, Skelton and Ring were stopped by the local police and all samples from Sifnos were confiscated because Skelton and Ring did not have paperwork connecting them to an academic institute in Greece. In less than an hour and before the plane departed to Athens, Christina, Marina and Giorgos at NEO came to the rescue with a permission letter and the police kindly returned the samples minutes before the plane took off for Athens.

Skelton and Ring are hugely appreciative of the help they received from Christina, Marina and Giorgos and also the police on Milos who were extremely friendly throughout the entire awkward process.

We remind all NEO researchers that samples cannot be taken from Greece without paperwork stating that the researchers are connected to an academic institute.

- **NEO PhD thesis, April 28**

**Barbara I. Kleine**, 2015. *How do metamorphic fluids move through rocks? An investigation of timescales, infiltration mechanisms and mineralogical controls*. PhD Dissertation, No. 356 (Geology), Department of Geological Sciences, Stockholm University, Sweden. ISBN 978-91-7649-120-1, Printed in Sweden by Holmbergs, Malmö 2015, Distributor: Publit

### Abstract

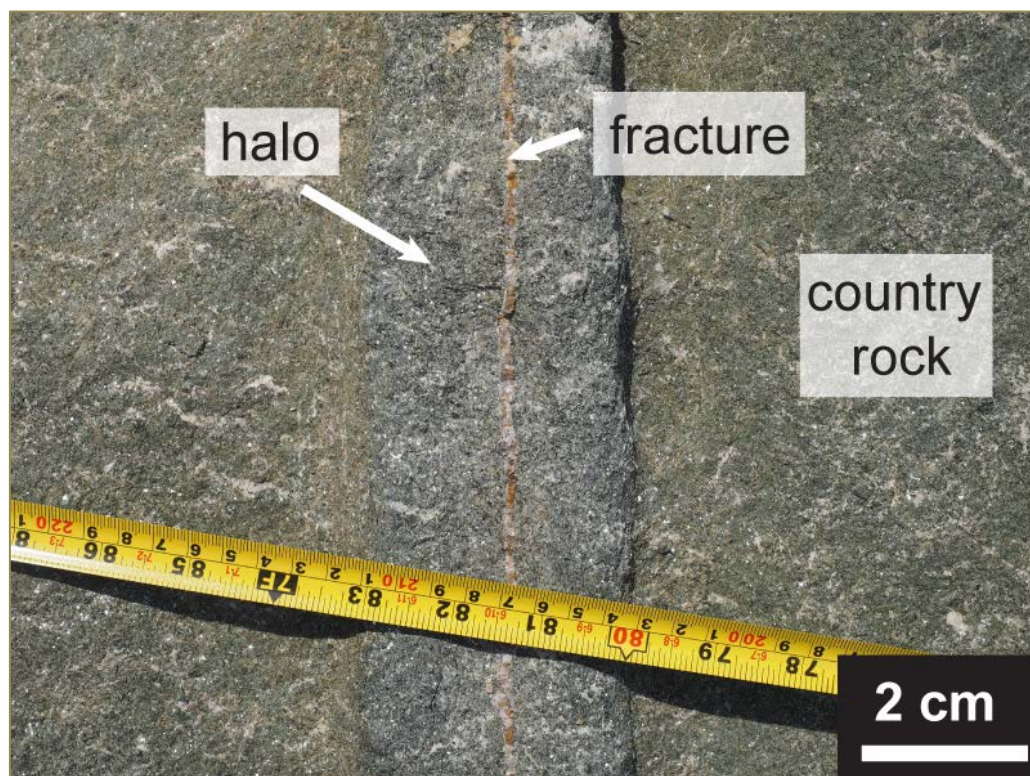
This thesis aims to provide a better understanding of the role of mountain building in the carbon cycle. The amount of CO<sub>2</sub> released into the atmosphere due to metamorphic processes is largely unknown. The release of high quantities of metamorphic CO<sub>2</sub> could affect the Earth's climate. However, does the release of CO<sub>2</sub> occur slowly and at a constant rate or as a series of rapid pulses? To constrain the quantity of CO<sub>2</sub> released, fluid-driven reactions in metamorphic rocks can be studied by tracking fluid-rock interactions along ancient fluid flow pathways (figure 1).



**Figure 1.** An example of an ancient fluid flow pathway. Here, a fracture was used by a fluid phase to travel upwards in Earth's crust. The fluid interacted with rock adjacent to the fracture and changed its chemical composition and mineralogy (orange-brown areas).

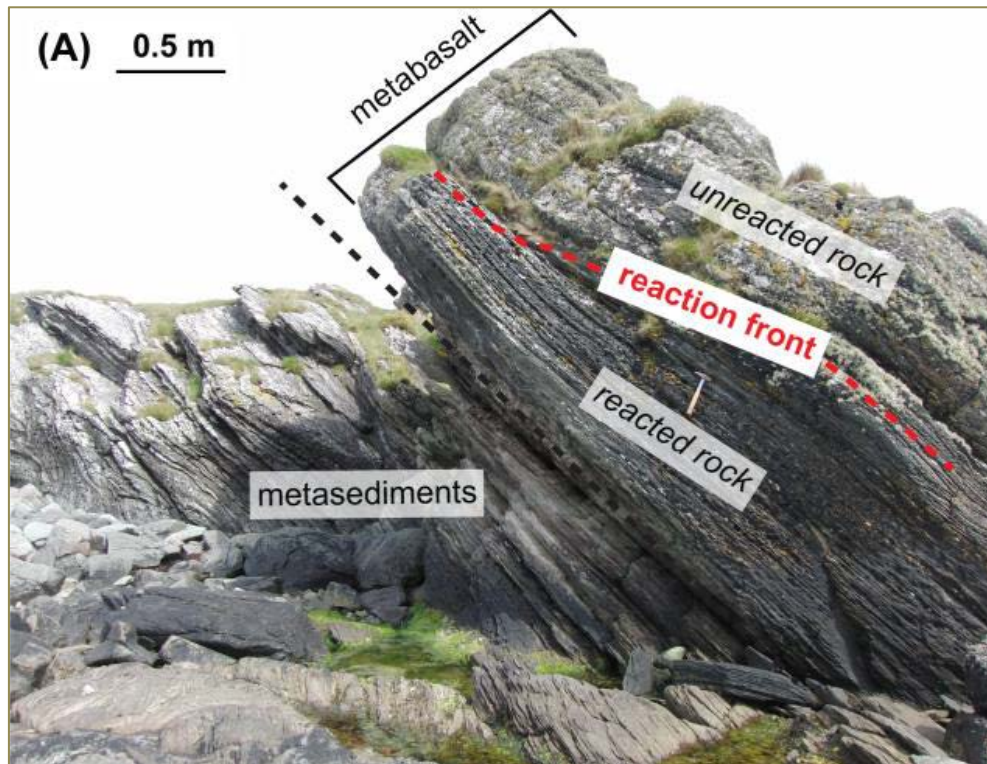
The thesis is divided into two parts: 1) the modeling of fluid flow rates and durations within zones of structural weakness (e.g. shear zones, fractures) in metamorphic rocks formed at high pressures and temperatures and 2) the assessment of possible mechanisms of fluid infiltration into rocks and controlling mineralogical factors of reaction front propagation.

The first part of this thesis focuses on a set of outcrops on the island Syros, Greece. Here, fluid-rock interaction was examined along a shear zone and within brittle fractures to calculate fluid flux rates, flow velocities and durations (figure 2). Petrological, geochemical and thermodynamic evidence show that the flux of CO<sub>2</sub>-bearing fluids along the shear zone was 100-2000 times larger than the fluid flux in the surrounding rocks. Further, by using reactive transport modeling fluid flow rates were calculated along brittle fractures. Results of this study show that fluid flow was even more rapid (10<sup>-6</sup> to 10<sup>-5</sup> ms<sup>-1</sup>) and short lived (40 days to 400 years) along these fractures. The findings from these studies of fluid flow along shear zones and fractures would consolidate the idea that the release of CO<sub>2</sub> would occur in a series of rapid pluses rather than at a constant rate.



**Figure 2.** A fracture surrounded by a distinct reaction halo. The extension of the halo can be used to model fluid flow along the fracture.

The second part of this thesis focuses on a group of metamorphosed basaltic sills in the southwestern Scottish Highlands that intruded into sedimentary layers. This sequence was infiltrated by H<sub>2</sub>O-CO<sub>2</sub>-bearing fluids during metamorphism that causes a carbonation reaction in the margins of the sills (figure 3). The metabasaltic sills were used to assess possible mechanisms and controlling factors of fluid infiltration and the position of fluid-driven reaction fronts. Fluid infiltration into metabasaltic sills was unassisted by deformation and occurred along grain boundaries of hydrous minerals (e.g. amphibole) while other minerals (e.g. quartz) prevent fluid infiltration. Petrological, mineralogical and chemical evidence of the sills suggest that the availability of reactant minerals and mechanical factors, e.g. volume change in minerals (e.g. epidote), controls the position of fluid-driven reaction fronts.



**Figure 3.** Basaltic sills intruded into sedimentary layers. During metamorphism fluids caused a carbonation reaction in the sill margins.

- **Licentiate exam, June 2**

**Ruben Fritzon**, 2015. Evaluation of a geochemical method for investigating paleoseismic activity of the Sparta Fault, Greece. Ahlmannsalen, June 2015.

**Abstract**

Determining earthquake periodicity and the magnitude of prehistoric earthquakes is important for people living in seismically active areas. We evaluate a geochemical method, which has previously been used to identify prehistoric slips on normal fault scarps, through an analysis of variations in the concentration of rare earth elements and Y (REE-Y) along vertical transects. Our study object is the Sparta Fault, a normal fault in southern Greece, developed in limestone and previously documented, and dated using <sup>36</sup>Cl, to have been last active 464 BC. From geochemical analyses of 39 fault rock samples, we conclude that REE-Y concentrations correlate strongly with the abundance of quartz and possibly other heterogeneities in the fault scarp. Because the sampled fault rock is a protocataclasite, formed at depth, variations in the abundance of quartz are not associated with prehistoric movements along the fault. We therefore conclude that geochemical evidence does not provide a reliable paleoseismic proxy for fault movement. We also present data indicating a co-variation between quartz and <sup>36</sup>Cl concentrations, which we suggest requires a re-examination of this widely used application of the cosmogenic nuclide surface exposure dating method.

## Education

### Courses

- “General Geochemistry course”  
Bachelor students’ course, Stockholm University (May 3-8)

This course is an introduction to the field Geochemistry. The course applies fundamental chemical principles to understand and describe geological processes and is catered to first and second year bachelor students. The course is divided up into weekly moments in which acid-base equilibria, redox processes, solubility, mineral chemistry, stable and radiogenic isotopes, kinetics, cosmochemistry, and fundamental thermodynamic principles are covered. The particular focus for the week at the Navarino station is low-temperature geochemistry and the application of acid-base properties and redox processes to understand the chemical composition and geochemical processes in aquatic and sedimentary systems. At the station, there will be lectures and theoretical exercises combined with two field moments, in which we conduct field measurements in Gialova wetland and collect marine and freshwater samples for chemical analysis..

- “Eco-hydrology - a Mediterranean perspective”  
Master students’ course, Stockholm University (June 13-20)

The relations between hydrological processes and ecosystems as well as societies are particularly deep in Mediterranean regions, where water availability varies significantly at season time scales and inter-annually. Following water in all components of the ecosystem and at different scales, this course examined how eco-hydrological processes shape form and function of human societies, landscapes, plant communities, and agricultural systems in Mediterranean regions. Lectures held at Stockholm University and NEO provided students with key hydrological, geomorphological, ecological, and physiological concepts. The lectures spanned a multitude of spatial and temporal scales (Figure below), with four main lecturers (Stefano Manzoni and Steve Lyon from SU, Giulia Vico from SLU Uppsala, and Daniele Way from University of Western Ontario, Canada) and five guest lecturer.

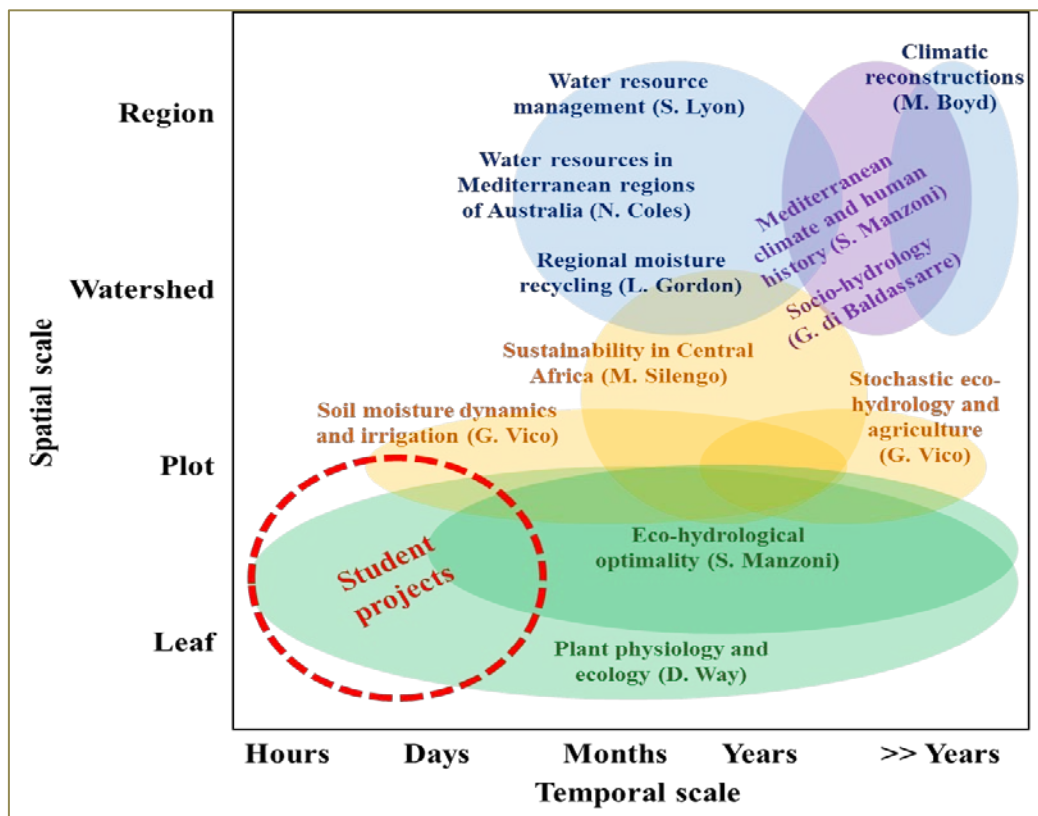


Figure 4: Eco-hydrology at multiple spatial and temporal scales.

An eco-hydrology symposium was organized by Steve Lyon during the course to facilitate student interactions with researchers addressing water scarcity issues globally. Concepts from the lectures have been applied to field experiments performed at and around NEO during a full week of activities. Students developed their own research hypotheses and designed experiments to test them – looking at plant biophysics and ecology in relation to water availability in both natural plant communities and in agricultural systems. These activities would have not been possible without the hospitality of NEO and its staff.



**Figure 5:** Students and teachers on Palaiokasto during the Eco-hydrology course.

### **Bachelor degree thesis, May 27 – June 3**

Jennifer Isaksson and Tove Lagerbo from the Biology/Earth Science program at Stockholm University, visited NEO for a week in order to realize fieldwork for their bachelor degree thesis. Jennifer worked on **"Mapping habitats of importance in Gialova Lagoon, a Naturazoo area"** and Tove on **"Use of biomass for energy purpose"**.

### **Master thesis, May 22-28**

Giulio Deboni, a master student in Landscape Ecology, Stockholm University visited NEO for a week in order to conduct preliminary field work for his Master thesis. Giulio is working on **"Bees in the agricultural landscape of southern Greece – beekeeping distribution and management: does honeybee presence affect wild bees abundance?"** under the supervision of Sara Cousins, Professor at the Physical Geography department, Stockholm University.

### **Traineeship**

- **"Design and initiate a digitalized Gialova database", April 13 – June 20**

Alice Guittard, a master student following "Geomatic with Remote Sensing and GIS" Master course at SU realized a two month traineeship at NEO. The purpose of the traineeship was to "Design and initiate a digitalized Gialova database". The traineeship included different tasks such as:

- Digitalize and georeference old maps and aerial photos of the area
- Design of the database frame work in collaboration with Hakan Grudd (Bolin Center)
- Transform data (on flora/fauna distribution, water resource, land use) into GIS format
- GPS field work (collect ground control point; control previous data collection)

The traineeship was conducted under the supervision of Giorgos Maneas with scientific support from Dr. Hakan Grudd.

## Events

### Workshops

- **“GWEN perspective Workshop on Wetland-hydrological Interactions” , April 30 - May 1**

The GWEN network (Global Wetland Ecohydrology Network) is an agora for scientists and study sites with the overall network aim to investigate, quantify and compare wetland characteristics across different scales, hydroclimatic, wetland, human disturbance and organization condition (<http://www.gwennetwork.se/>). This international workshop was centered on discussing wetland-hydrological interactions and, more specifically, analyze how different change trajectories in hydrology can affect or have affected wetland functions. This workshop acted as a capacitor for an upcoming joint paper on these issues.



**Figure 6** Participants at the GWEN network workshop.

### **Five years of frontline research and education on climate change in the Mediterranean region, May 18**

The research and educational work carried out by Navarino Environmental Observatory (NEO) since 2010 as well as the renewal of the collaboration between the three parties for the next five years were the main themes of a successful event that took place at the Academy of Athens.

Held under the Auspices of the Presidency of the Hellenic Republic, the well-attended event was honored by the presence of H.E. the President of the Hellenic Republic Mr. Prokopios Pavlopoulos and of the President of the Royal Swedish Academy of Sciences Professor Barbara Cannon. Representatives of the state, the regional and local authorities, the academic and the scientific world, as well as many other dignitaries joined on this occasion.

The renewal of the collaboration between the three parties for the next five years is expected to further enhance the environmental and educational work of Navarino Environmental Observatory and reaffirms the commitment of the three parties in the top level research conducted in NEO. At the same time, it proves that the academic community and the private sector can work together in the field of research and education on climate change and the environment in the Mediterranean region.





**Figure 7:** NEO event at the Academy of Athens.

Prior to the Official event, a Scientific Workshop under the theme: **“Peloponnese: From Paleoclimate to Anthropocene”** took place at the at “Alkis Argiriadis” Auditorium, Academy of Athens, where NEO researchers had the opportunity to present and discuss their results with the workshop participants.

### **Scientific Workshop Program**

**“Three million years of Earth History in Southern Peloponnese”**, Johan Kleman, Professor and Vice President - Strategic Partnerships, Stockholm University

**“The social-environmental history of the Peloponnese during the Holocene: Towards an integrated narrative”**, Karin Holmgren, Professor and Head of Department, Department of Physical Geography, Stockholm University; Director, Navarino Environmental Observatory

**“The Anthropocene in the Peloponnese”**, Christos Zerefos, Head, Research Center for Atmospheric Physics and Climatology of the Academy of Athens

**“Human-driven changes to the freshwater system - from the past to the future»**, Georgia Destouni, Department of Physical Geography, Stockholm University, Secretary General of The Swedish Research Council Formas

**“Studying new synergies of climate change in a continuously changing environment - the Messinia case”**, Evangelos Gerasopoulos, Research Director, Institute of Environmental Research and Sustainable Development of the National Observatory of Athens

**“Stories from trees”**, Håkan Grudd, Department of Physical Geography, Bolin Centre for Climate Research, Stockholm University



**Figure 8:** Participants at NEO Scientific Workshop held at the Academy of Athens.

### Dissemination

- **Scientific Publications**

**Koussis AD, Mazi K, Riou F, Destouni G, 2015.** A correction for Dupuit–Forchheimer interface flow models of seawater intrusion in unconfined coastal aquifers. *Journal of Hydrology* 525, 277–285, doi: 10.1016/j.jhydrol.2015.03.047

**Kalabokidis K., Palaiologou P., Gerasopoulos E., Giannakopoulos C., Kostopoulou E, Zerefos C., (2015) .** Effect of Climate Change Projections on Forest Fire Behavior and Values-at-Risk in Southwestern Greece. *Forests*, 6, 2214-2240; doi:10.3390/f6062214

- **Cafe-NEO**

**'Marine science and societies. Open discussion'**  
**Kalamata, May 7**

The last 'cafe-NEO' meeting before summer time took place at Vino-banco Tapas bar in Kalamata in May. The attendees had the opportunity to discuss with Dr. Vangelis Papathanassiou, Research director at HCMR (Hellenic Centre of Marine Research)!





Figure 9: Cafe-NEO at Vino-banco Tapas bar in Kalamata

- **Ecopolis awards, June 5**

Navarino Environmental Observatory (NEO) was distinguished at this year's Ecopolis Awards that focus on Environmental Awareness. Winning in the category "Environmental Work", NEO was acknowledged for its research work on climate change in the Mediterranean. ECOPOLIS Awards promote environmental awareness and engage the social participation of enterprises, associations and all involved stakeholders in undertaking or supporting actions oriented to this cause.

The prize, a statuette, was presented at a formal ceremony in Athens on Friday 5 June. Vassilis Karakousis, NEO Steering Committee, and Giorgos Maneas, NEO's station manager, were there and received the award.



Figure 10: Participants at the Ecopolis awards (left), Vassilis Karakousis, NEO Steering Committee (right)

- **Interviews/Press Releases**

Following the event for the presentation of NEO's five year research and educational work, as well as the renewal of the collaboration between the three parties, please find below the respective publicity:

- 13 publications in **print** media.
- 48 posts in **online** media.
- 1 radio interview on **98,4 FM** of Giorgos Maneas, NEO Station Manager.

- 1 interview in the newspaper **KATHIMERINI** of Prof. Barbara Cannon, President of the Royal Swedish Academy of Sciences, to the reporter Lina Giannarou.
- 1 interview of Giorgos Maneas in **tanea.gr/podcast**.
- 1 interview of Karin Holmgren, Director of NEO, in **huffingtonpost.gr**.
- 3 **TV** mentions (1 in the News Broadcast of **SKAI TV** within the context of the TV show ECO NEWS, 1 in the TV show ECO NEWS in **SKAI TV** and 1 in the News Broadcast of **ANT1 TV**)

Following the Press Release of NEO for the award ceremony of the OIKOPOLIS Awards 2015, please find below the respective publicity:

- 1 publication in **print** media (THARROS MESSINIAS)
- 3 posts in **online** media (NEWS.GTP.GR, TORNOSNEWS.GR, BOLIN.SU.SE)
- Following the Press Release announcing the winners of the OIKOPOLIS Awards 2015, please find below the respective publicity:
- 2 publications in **print** media (ELEFThERIA KALAMATAS, REVIEW CSR)
- 10 posts in **online** media (SOFOKLEOUSIN.GR, BUSINESSNEWS.GR, ONAIRNEWS.GR, ECONNEWS.GR, CSRNEWS.GR, ENERGYPRESS.GR, BUSINESSWOMAN.GR, KPYLOS.BLOGSPOT.GR, ELEFThERIAONLINE.GR, GARGALIANOIONLINE.GR)

- **Astronomy nights, Costa Navarino, summer 2015**

"Astronomy nights" is an interactive experience at Costa Navarino organized by the Navarino Environmental Observatory where visitors are introduced to the stars and the constellations of the night sky and they become the astronomers deciding how the night unfolds.



**Figure 11:** Astronomical observations at Costa Navarino

Under the guidance of the National Observatory of Athens and with the excellent support from the Navarino Collections team, we have managed to organize this event on a weekly basis and we are happy to see that it is fully booked!

### [NEO management](#)

NEO Steering Committee was held in Athens in May.

## Upcoming

### Research

- Researchers Johan Kleman and Ingmar Borgstrom are planning for a field trip on Taygetos summit this September.

### Education

- Students of the Justus-Liebig University of Giessen (a NEO Associated Member), Germany, will visit NEO in September as part of their-course "Climate, Climate Change Impacts: Greece".
- As part of a one semester Natural Science Specialization course a group of students from the upper secondary school, Värmdö Gymnasium, will visit NEO in October.

### Events

- A workshop with special focus on the history and climate-environmental settings of the Peloponnese will take place at NEO, November 9-11.