

BOREMED

Boron Contamination of Water Resources in the Mediterranean region: distribution, sources, social impact and remediation

Research team

Th. Kouimtzis¹, D. Voutsas¹, A. Kouras¹, E. Dotsika², D. Poutoukis³

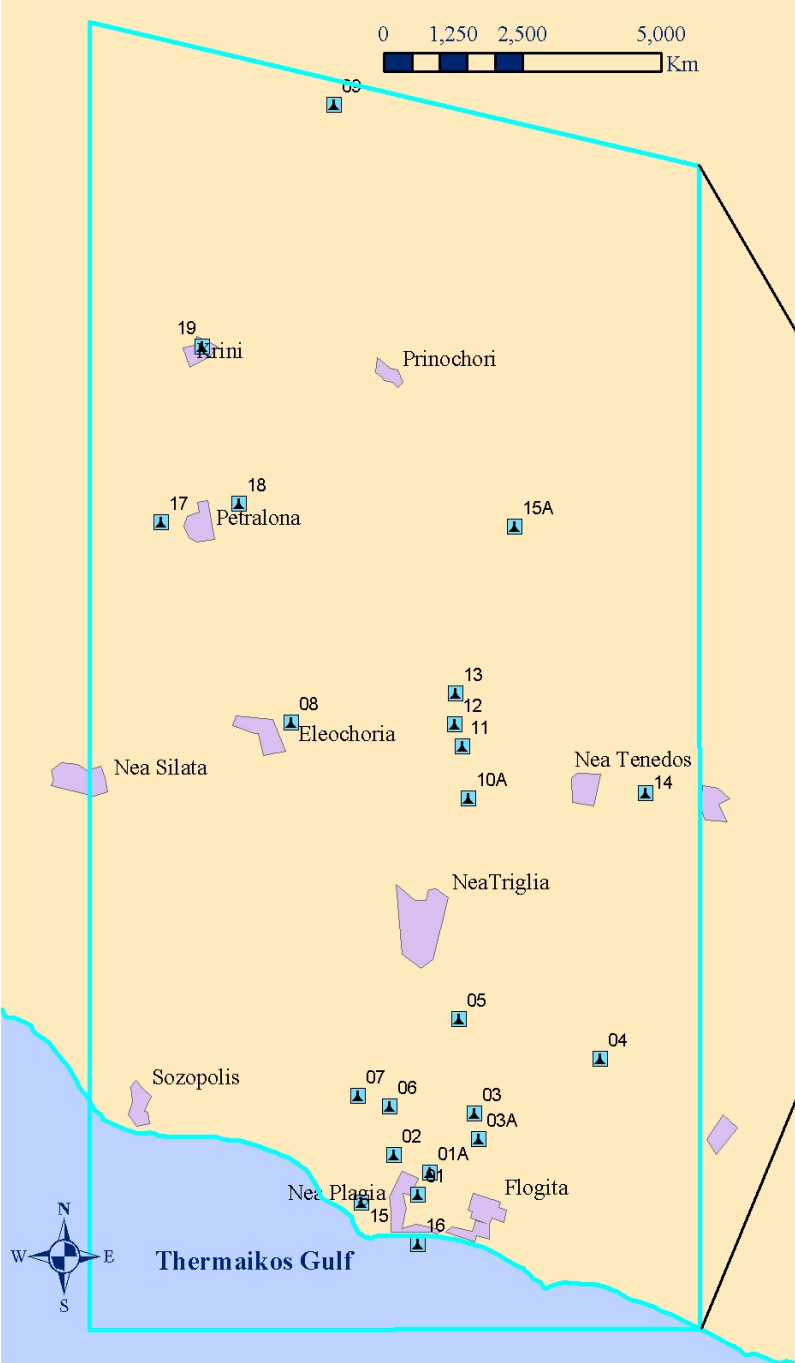
¹ *Environmental Pollution Control Laboratory*

Department of Chemistry, Aristotle University of Thessaloniki

² *Institute of Materials Science, National Centre for Scientific Research DEMOKRITOS*

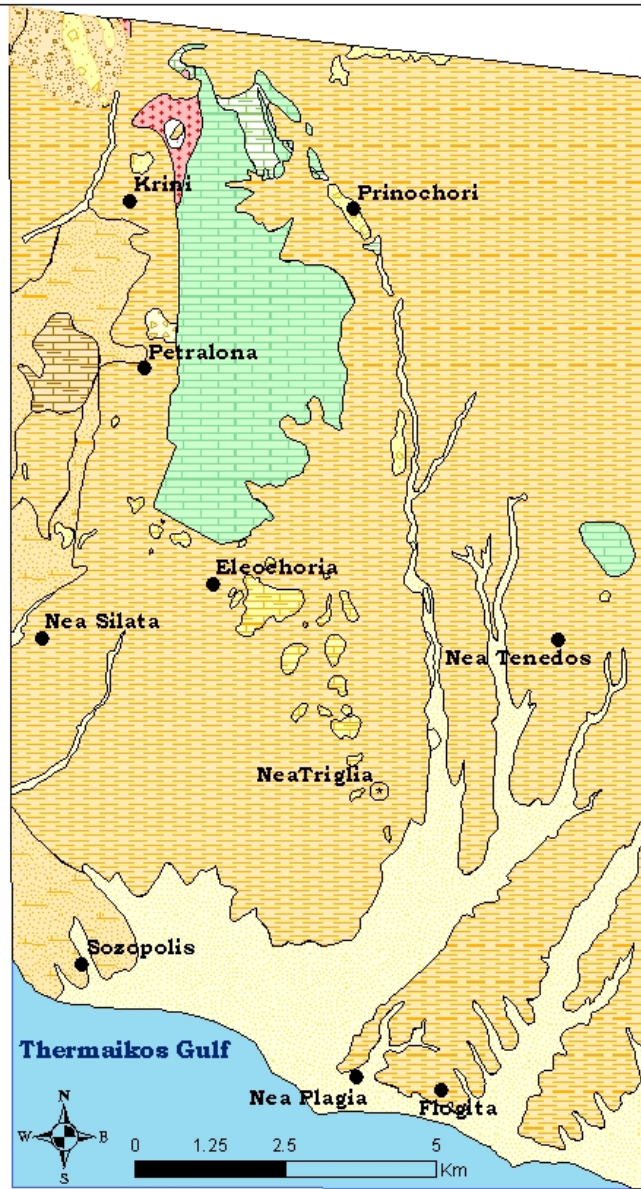
³ *General Secretariat for Research and Technology*

MAP OF THE STUDY AREA NEA TRIGLIA, CHALKIDIKI, GREECE



**Greater area
of Municipality of Nea Triglia
Perfection of Chalkidiki, Greece**

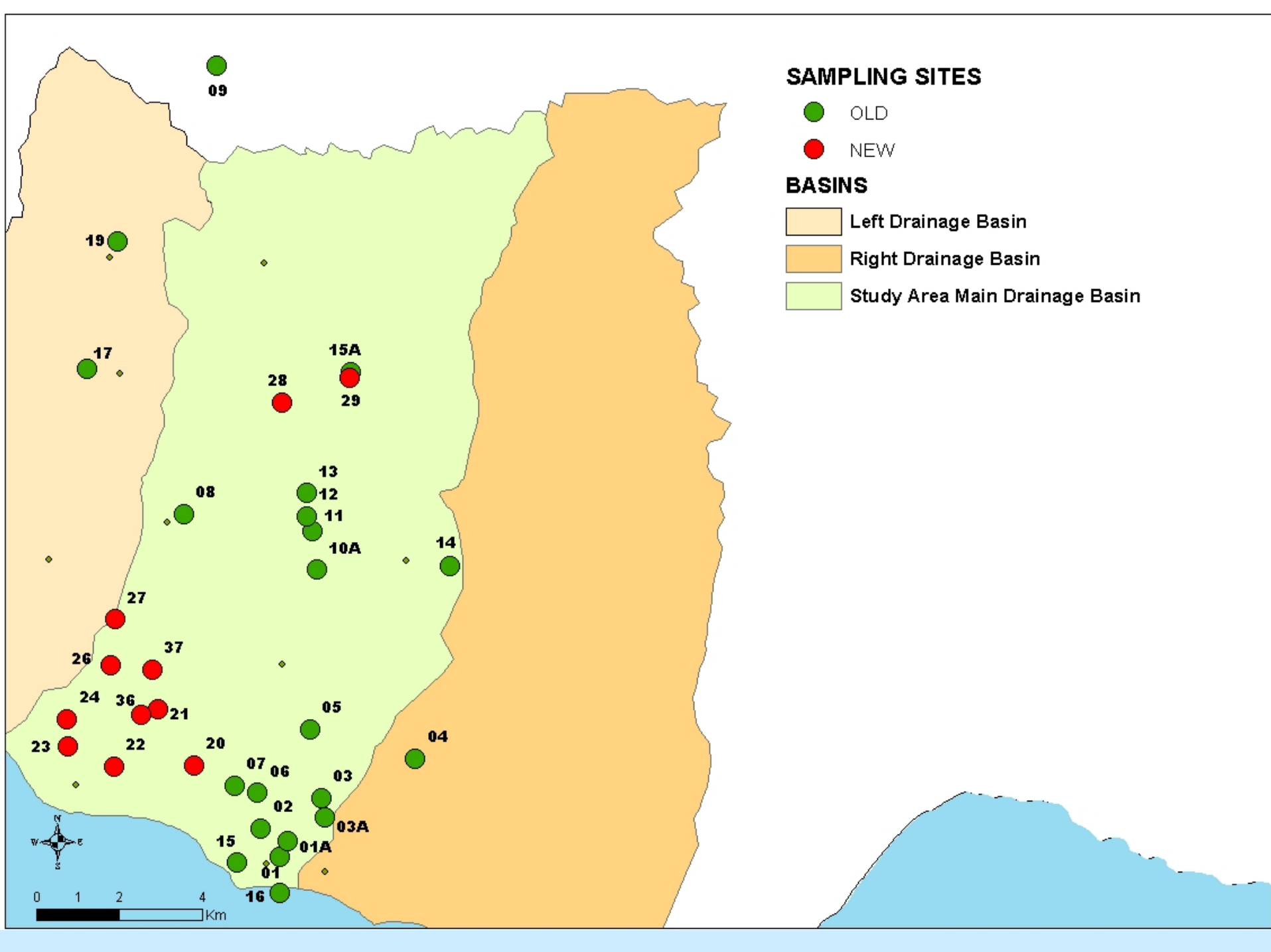
Study site : 190 km²
Coordinates : N 40° 15' – 40° 26'
E 23° 06' – 23° 16'

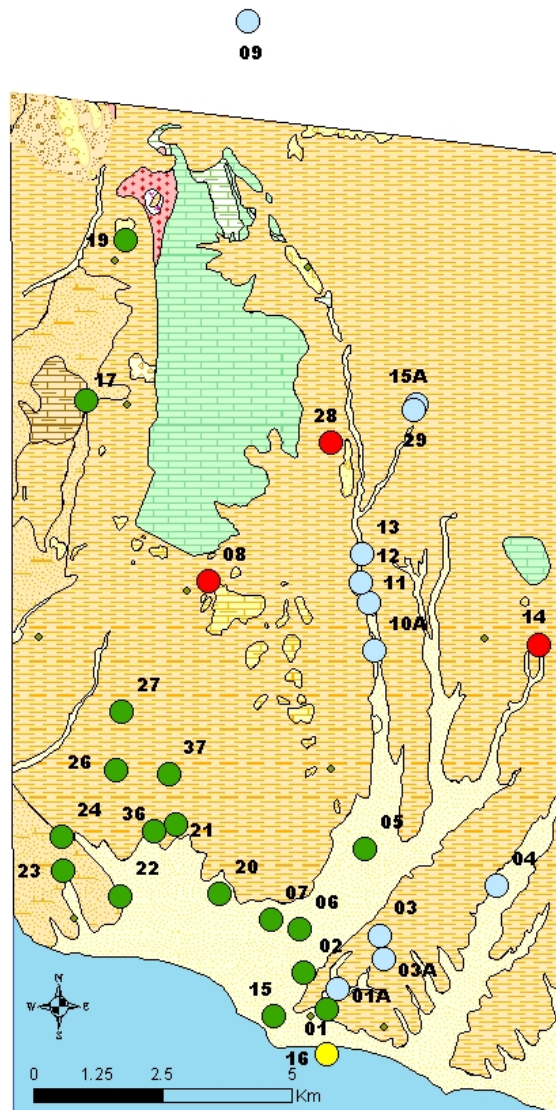


GEOLOGICAL MAP OF THE STUDY AREA

Geological Formations

-  Mesozoic Biotite & two-mica granodiorite
-  Mesozoic Diopside hornfels
-  Neogene Basic Conglomerates Series
-  Neogene Lacustrine Limestones and Hard Marls
-  Neogene Red Clay Series
-  Neogene Sandstone - Marl Series
-  Neogene Travertine Limestones
-  Pleistocene Upper Terrace System
-  Quaternary Holocene Alluvial Deposits
-  Quaternary Holocene Lower Stage of the Lowest Terrace System
-  Quaternary Holocene Scree
-  SEA
-  Upper Jurassic Limestones
-  Upper Jurassic Prinochori Beds





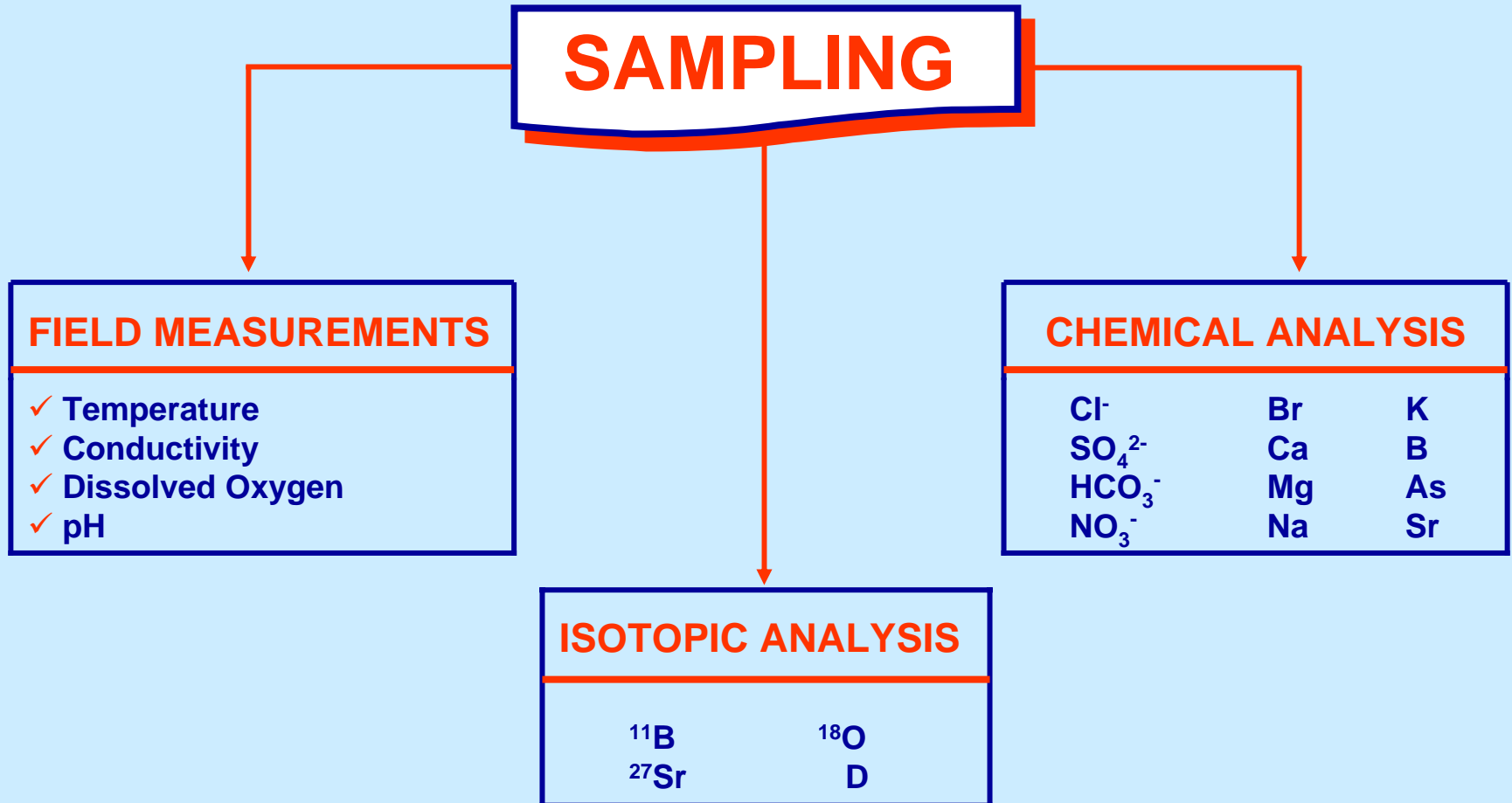
Water Use

- Irrigation Water
- Drinking Water
- Geothermal Irrigation Water
- Sea water

Geological Formations

- Mesozoic Biotite & two-mica granodiorite
- Mesozoic Diopside hornfels
- Neogene Basic Conglomerates Series
- Neogene Lacustrine Limestones and Hard Marls
- Neogene Red Clay Series
- Neogene Sandstone - Marl Series
- Neogene Travertine Limestones
- Pleistocene Upper Terrace System
- Quaternary Holocene Alluvial Deposits
- Quaternary Holocene Lower Stage of the Lowest Terrace System
- Quaternary Holocene Scree
- SEA
- Upper Jurassic Limestones
- Upper Jurassic Prinochovi Beds

Sampling & Analytical Scheme



Analytical Methods



Chemical Parameters Analytical Methods

B Photometric (curcumin method)

Cl⁻, SO₄⁻², NO₃, Br Ion Chromatography

HCO₃⁻ Titrimetric (H₂SO₄)

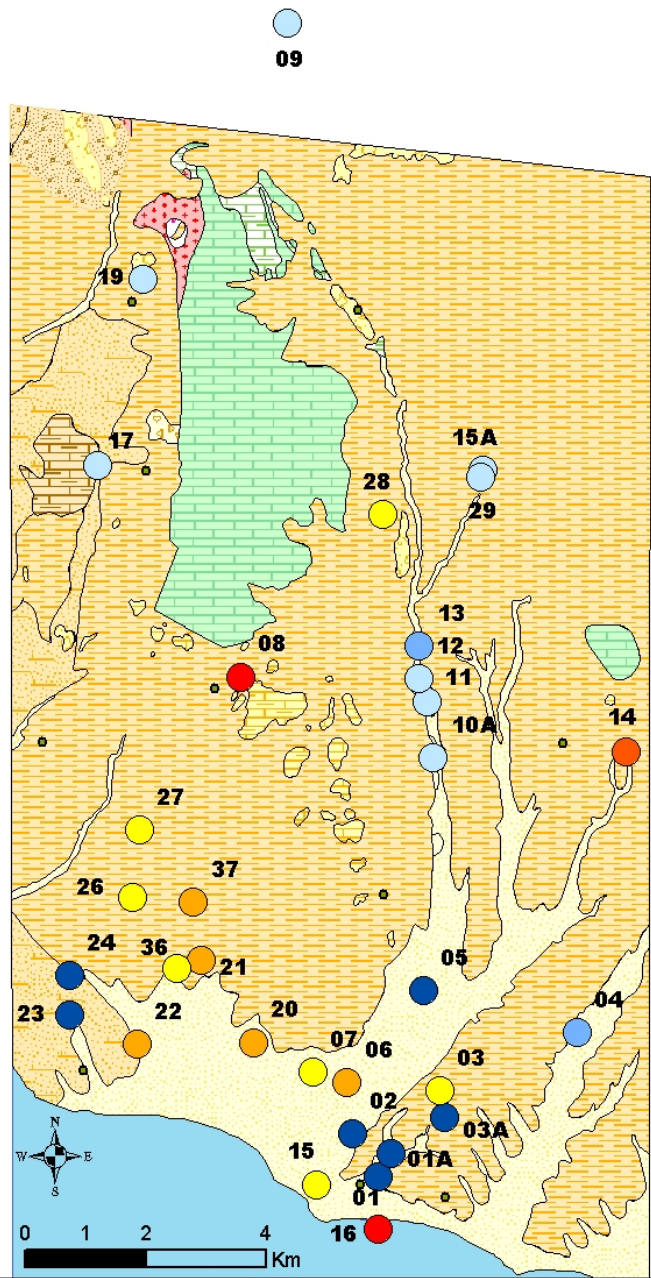
Ca, Mg, Sr Titrimetric (EDTA)
Atomic Absorption Spectrometry

Na, K Atomic Absorption Spectrometry /
Flame Emission Photometric

As Atomic Absorption Spectrometry /
Hydride Generation System

Summary statistics

- 40 sampling sites
- 22 parameters physicochemical parameters
- pH, EC, DO, T in situ
- Cl, F, Br, NO₃, SO₄, Na, K, NH₄, Ca, Mg
- B, Sr, Li, Fe, Mn, As, Zn
- B, Sr isotopes
- ¹⁸O, ²H



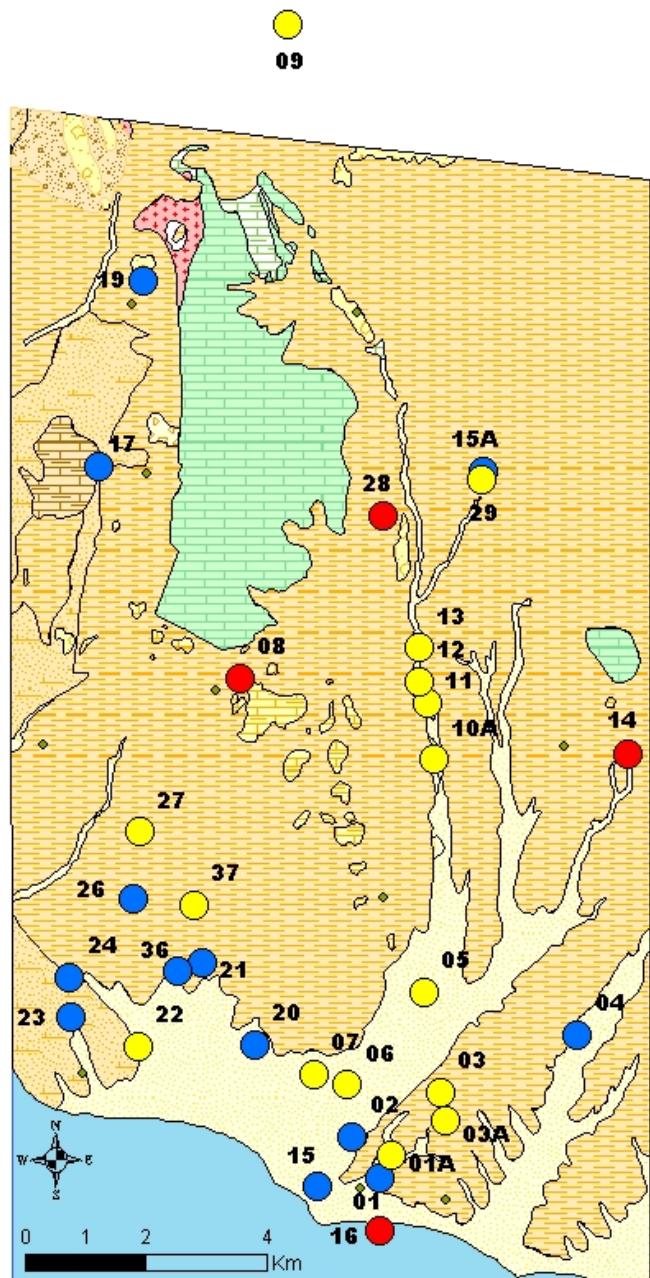
Legend

Boron (mg/L)

- < 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- 4.0 - 5.0
- 5.0 - 6.0

Geological Formations

- Mesozoic Biotite & two-mica granodiorite
- Mesozoic Diopside hornfels
- Neogene Basic Conglomerates Series
- Neogene Lacustrine Limestones and Hard Marls
- Neogene Red Clay Series
- Neogene Sandstone - Marl Series
- Neogene Travertine Limestones
- Pleistocene Upper Terrace System
- Quaternary Holocene Alluvial Deposits
- Quaternary Holocene Lower Stage of the Lowest Terrace System
- Quaternary Holocene Scree
- SEA
- Upper Jurassic Limestones
- Upper Jurassic Prinochori Beds



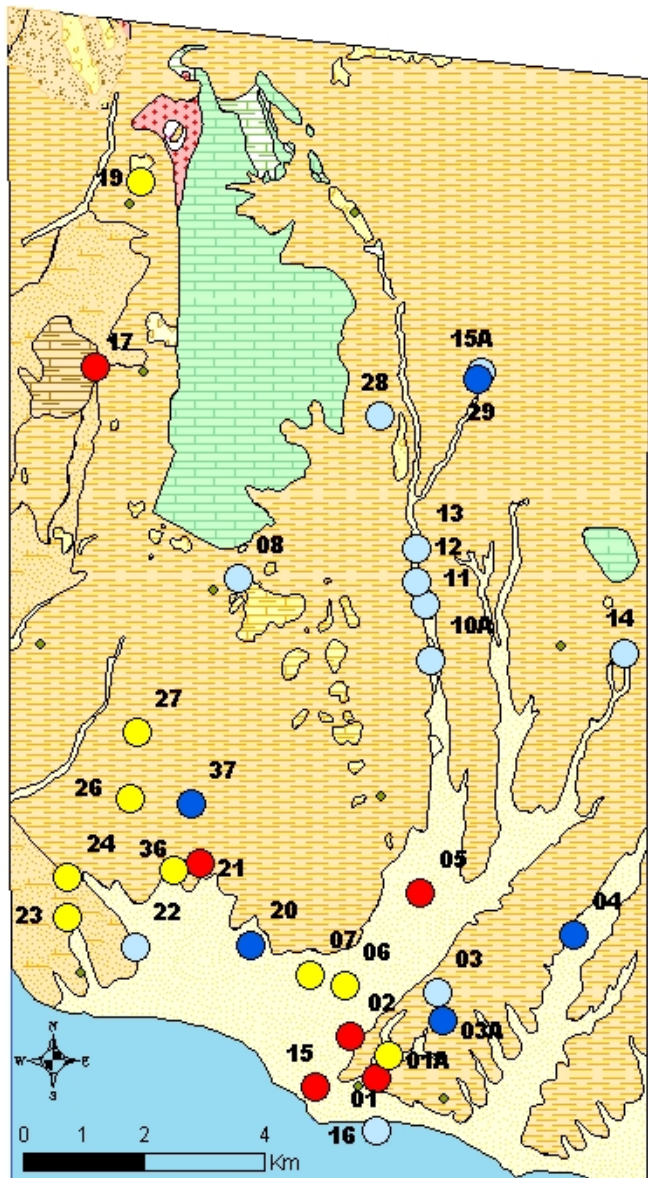
Temperature (°C)

- 15 - 20
- 20 - 25
- 25 - 50


Geological Formations

- Mesozoic Biotite & two-mica granodiorite
- Mesozoic Diopside hornfels
- Neogene Basic Conglomerates Series
- Neogene Lacustrine Limestones and Hard Marls
- Neogene Red Clay Series
- Neogene Sandstone - Marl Series
- Neogene Travertine Limestones
- Pleistocene Upper Terrace System
- Quaternary Holocene Alluvial Deposits
- Quaternary Holocene Lower Stage of the Lowest Terrace System
- Quaternary Holocene Scree
- SEA
- Upper Jurassic Limestones
- Upper Jurassic Prinochori Beds

09

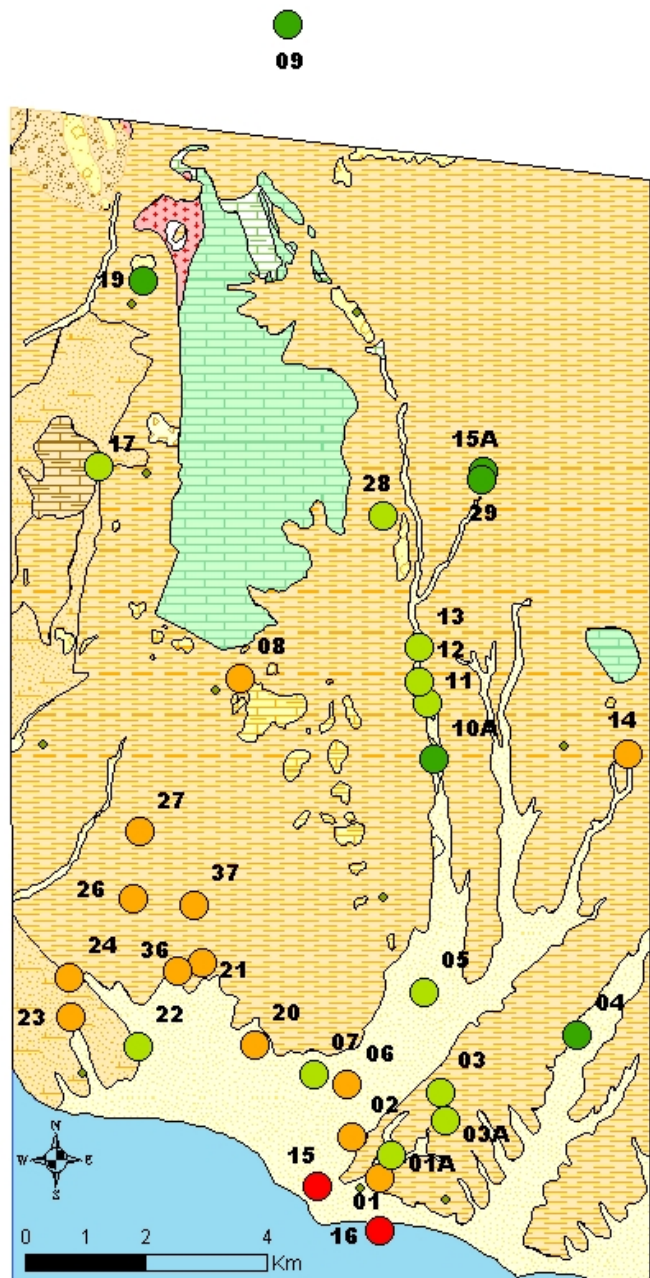


Nitrates (mg/L)

-  <10
-  10 - 25
-  25 - 50
-  > 50

Geological Formations

-  Mesozoic Biotite & two-mica granodiorite
-  Mesozoic Diopside hornfels
-  Neogene Basic Conglomerates Series
-  Neogene Lacustrine Limestones and Hard Marls
-  Neogene Red Clay Series
-  Neogene Sandstone - Marl Series
-  Neogene Travertine Limestones
-  Pleistocene Upper Terrace System
-  Quaternary Holocene Alluvial Deposits
-  Quaternary Holocene Lower Stage of the Lowest Terrace System
-  Quaternary Holocene Scree
-  SEA
-  Upper Jurassic Limestones
-  Upper Jurassic Prinochori Beds



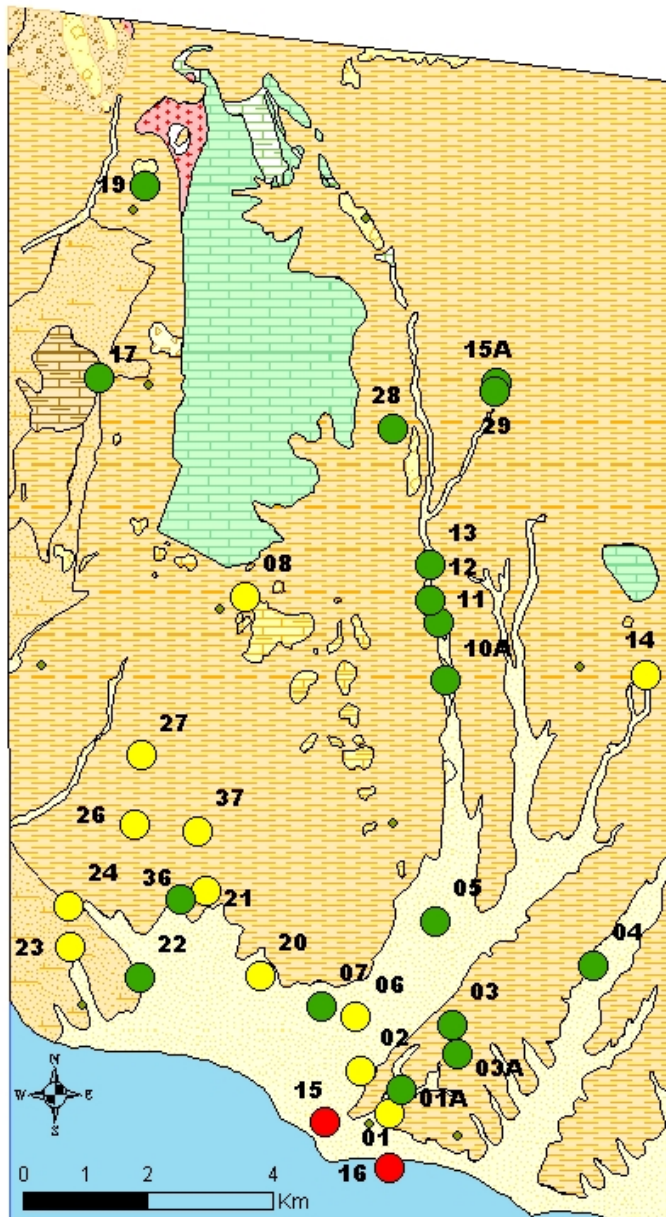
Conductivity ($\mu\text{S}/\text{cm}$)

- < 1000
- 1000 - 1500
- 1500 - 2500
- > 2500

Geological Formations

- Mesozoic Biotite & two-mica granodiorite
- Mesozoic Diopside hornfels
- Neogene Basic Conglomerates Series
- Neogene Lacustrine Limestones and Hard Marls
- Neogene Red Clay Series
- Neogene Sandstone - Marl Series
- Neogene Travertine Limestones
- Pleistocene Upper Terrace System
- Quaternary Holocene Alluvial Deposits
- Quaternary Holocene Lower Stage of the Lowest Terrace System
- Quaternary Holocene Scree
- SEA
- Upper Jurassic Limestones
- Upper Jurassic Prinochori Beds





09



Na (mg/L)

- < 100
- 100 - 200
- > 200

Geological Formations

-  Mesozoic Biotite & two-mica granodiorite
-  Mesozoic Diopside hornfels
-  Neogene Basic Conglomerates Series
-  Neogene Lacustrine Limestones and Hard Marls
-  Neogene Red Clay Series
-  Neogene Sandstone - Marl Series
-  Neogene Travertine Limestones
-  Pleistocene Upper Terrace System
-  Quaternary Holocene Alluvial Deposits
-  Quaternary Holocene Lower Stage of the Lowest Terrace System
-  Quaternary Holocene Scree
-  SEA
-  Upper Jurassic Limestones
-  Upper Jurassic Prinochori Beds

