

è un progetto

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Rifiuti acqua energia

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nna
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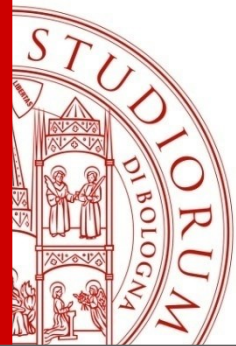
6^aEDIZIONE



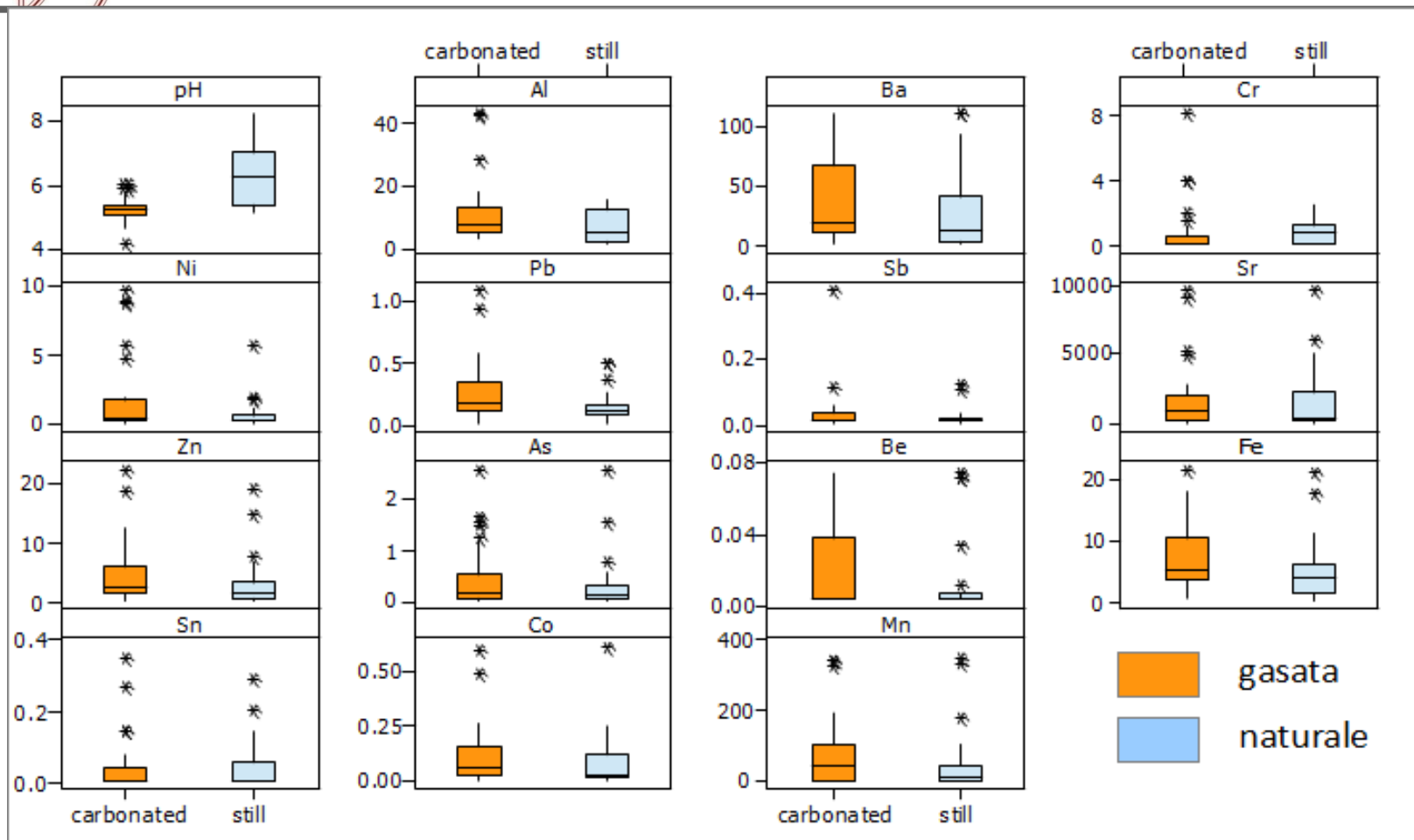
L'acqua interagisce con contenitori e sistemi di distribuzione: osservazioni ed evidenze sperimentali

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CIRSA (Centro Interdipartimentale di Ricerca per le Scienze Ambientali), Ravenna e
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Alma Mater Studiorum-Università di Bologna



Esiste una differenza tra acque gasate e naturali



CONTENITORI E MATERIALI IMPIEGATI

CARTONE POLITENATO (brick)

E' un materiale formato da carta per l'80% e da alluminio e polietilene. Viene riciclato tramite incenerimento con produzione di energia, o creando manufatti riciclati, o tritutando il materiale per produrre pannelli.



CLORURO DI POLIVINILE (PVC)

Il PVC può cedere all'acqua imbottigliata il CVM che è cancerogeno, ma è stato dimostrato che le quantità sono irrilevanti alla salute umana. Si ricicla ottenendo rivestimenti per cavi elettrici e tubi. Non più utilizzate.

POLIETILENETEREFTALATO (PET)

E' una materia plastica giovane derivante dal petrolio, il riciclaggio dà fibre di poliestere utilizzate nei tessuti, ma può anche essere utilizzato come combustibile alternativa per energia e calore. Sono le più diffuse sul mercato perché economicamente più vantaggiose

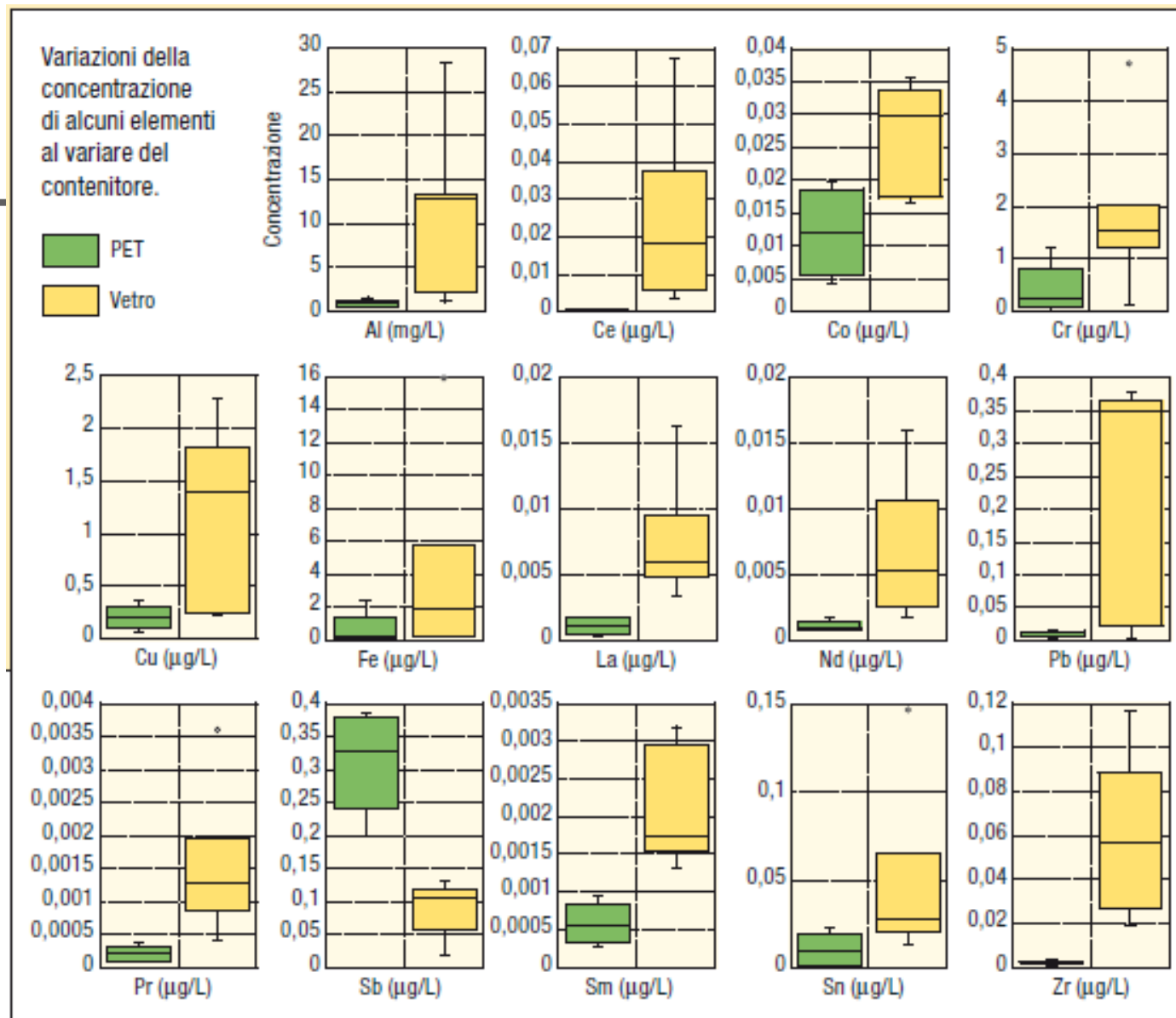


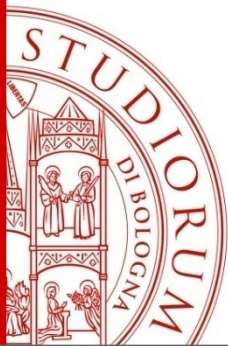
BOTTIGLIE DI VETRO

Sono costituite da carbonato di calcio e sabbia silicea, sono riutilizzate come "vetro a rendere" previo prelavaggio, il loro riciclaggio dà manufatti in vetro di qualità identica a quella che si otterrebbe da materie prime. Possono essere trasparenti o colorati, il colore dipende da componenti chimici naturali presenti nelle materie prime utilizzate.

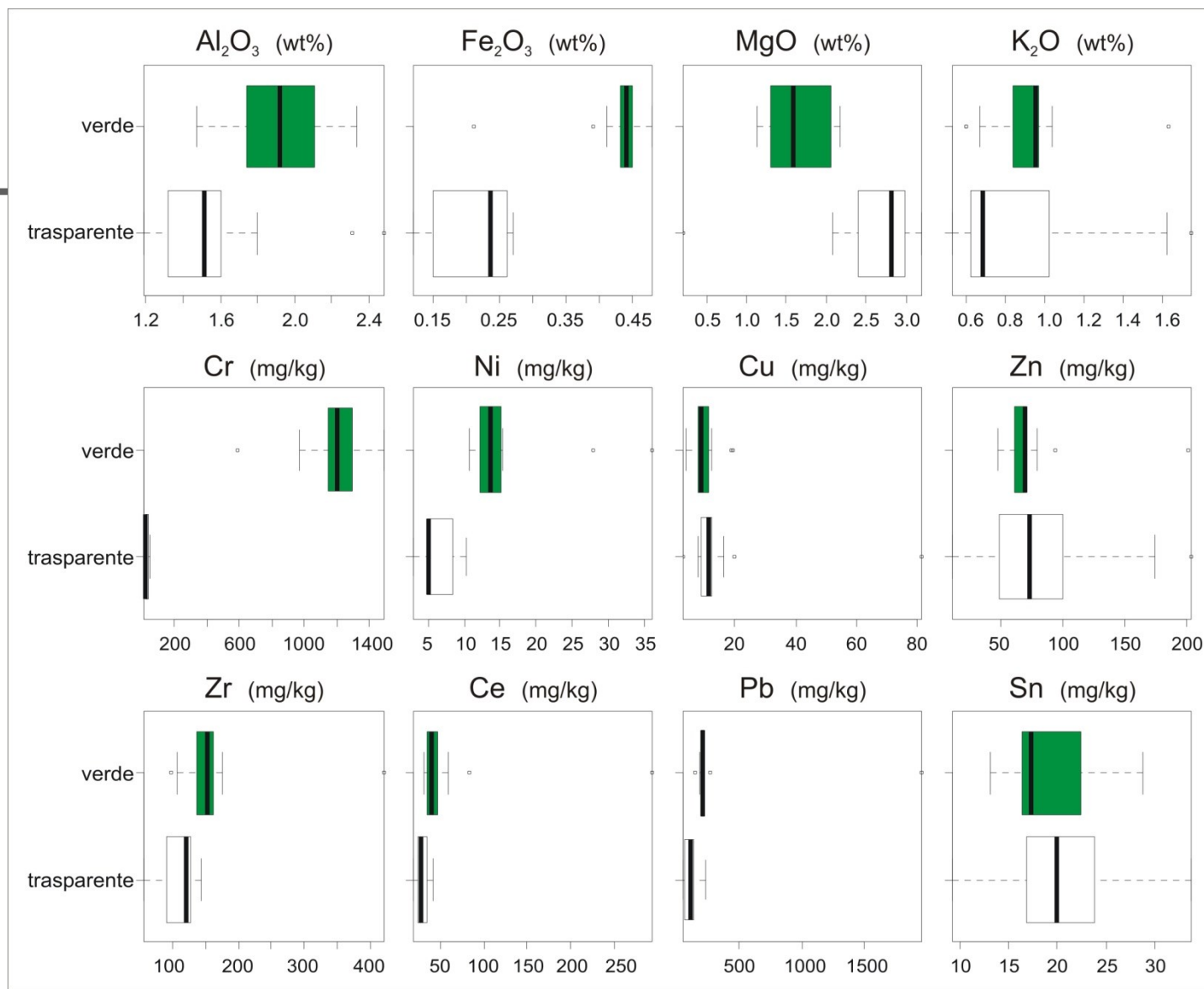


Effetto contenitore nelle acque minerali

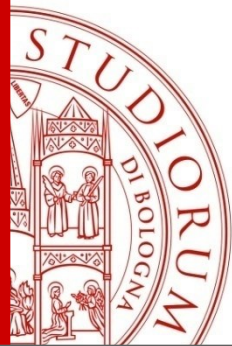




Non tutti i vetri sono uguali...



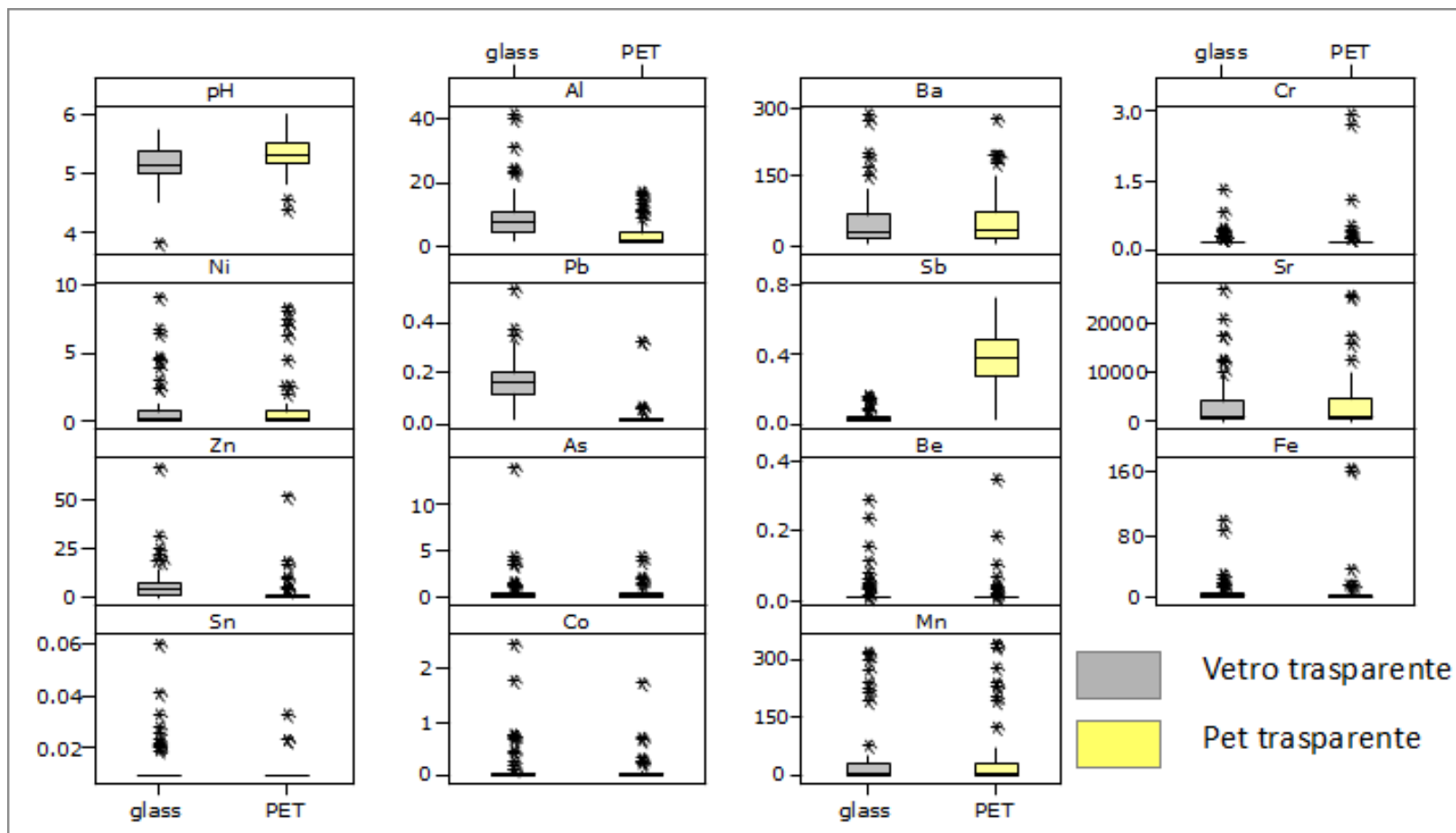
Dati originali di confronto tra bottiglie di vetro di diverso colore commercializzate in Italia

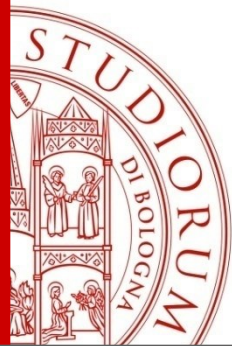


I vetri trasparenti

Confronto tra acque minerali conservate in contenitori di vetro e in contenitori di PET dello stesso colore.

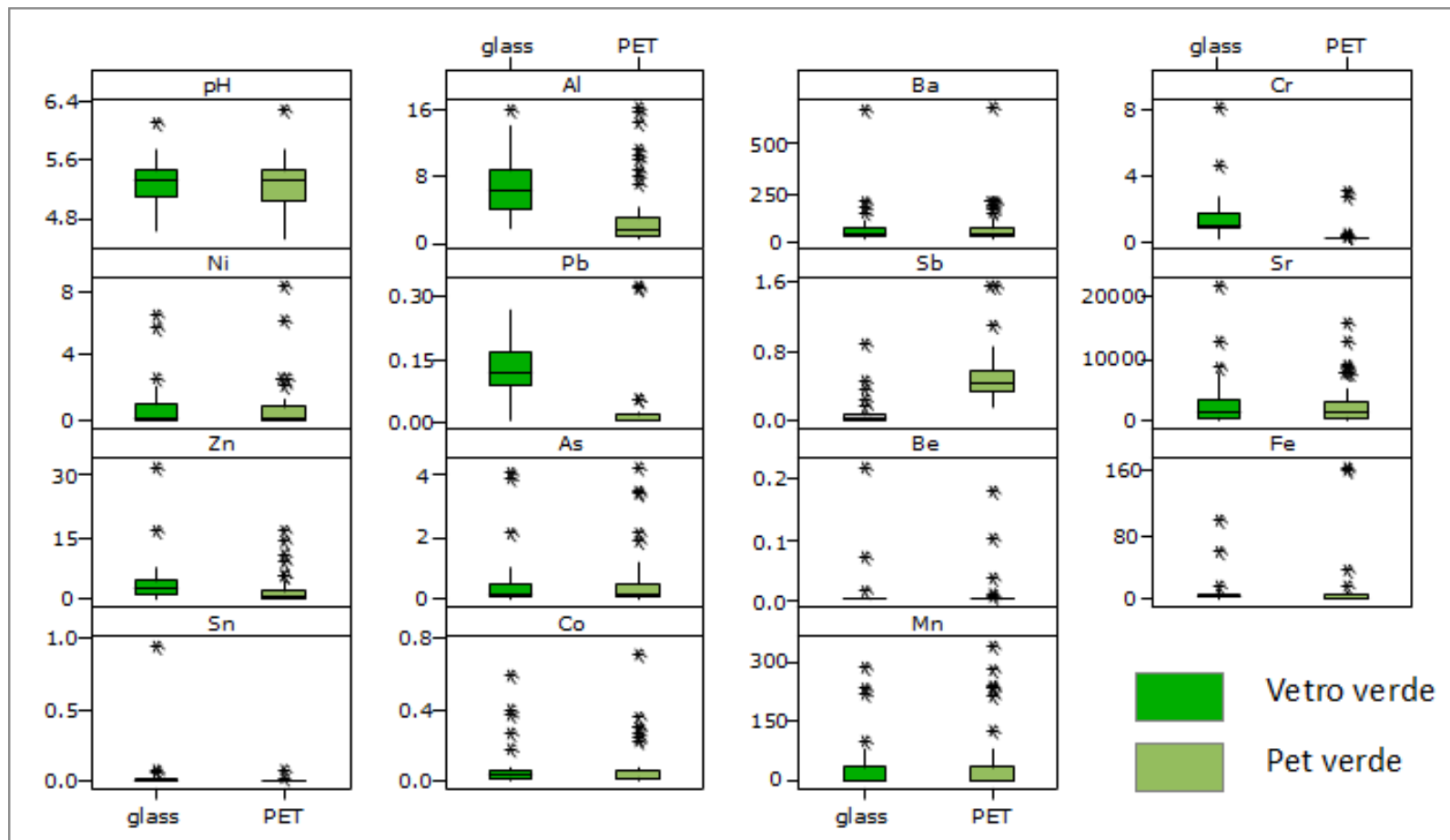
Confrontata la stessa etichetta

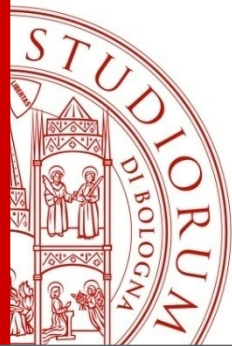




I vetri verdi

Confronto tra acque minerali conservate in contenitori di vetro e in contenitori di PET dello stesso colore.
Confrontata la stessa etichetta

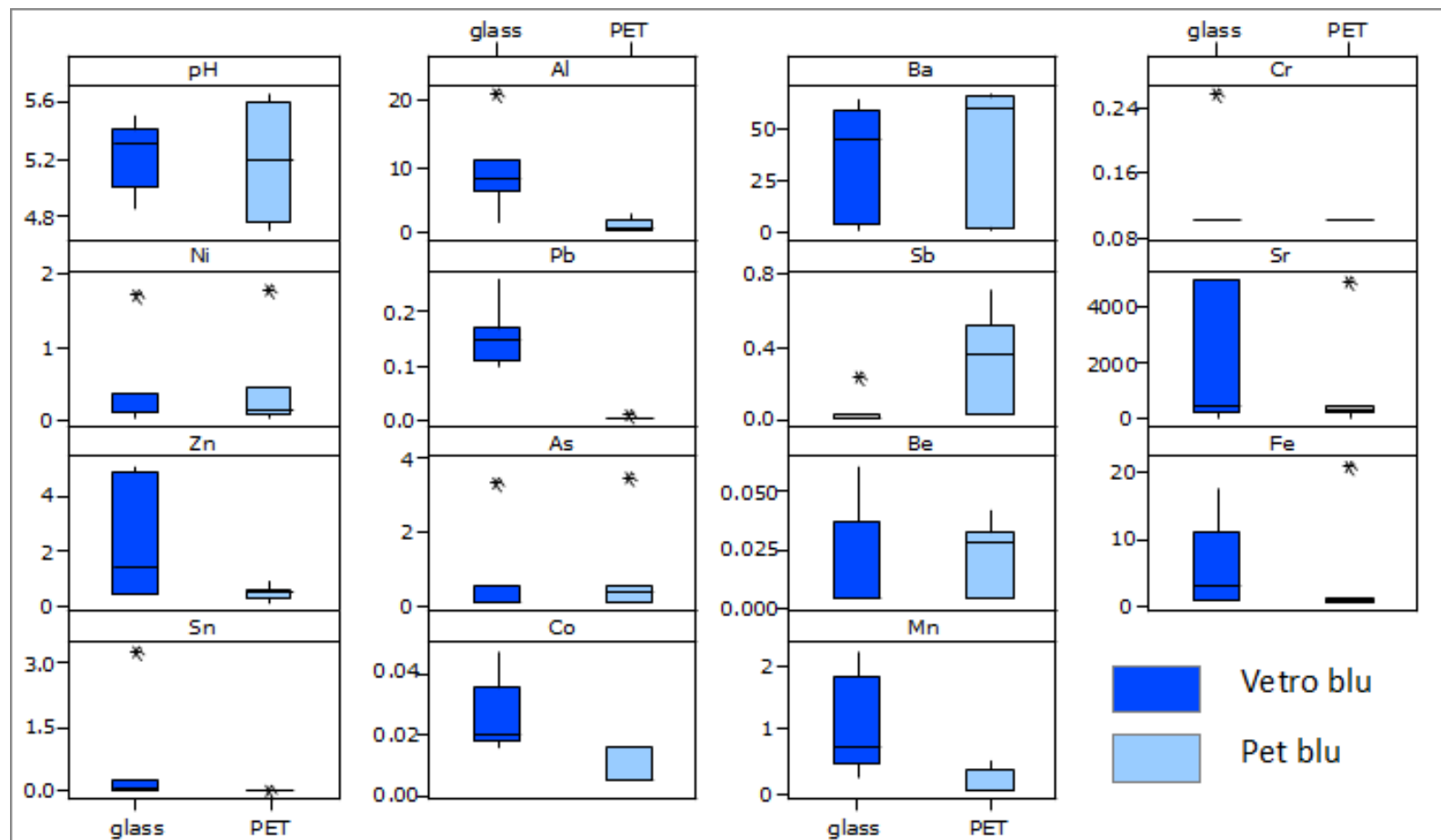




I vetri blu

Confronto tra acque minerali conservate in contenitori di vetro e in contenitori di PET dello stesso colore.

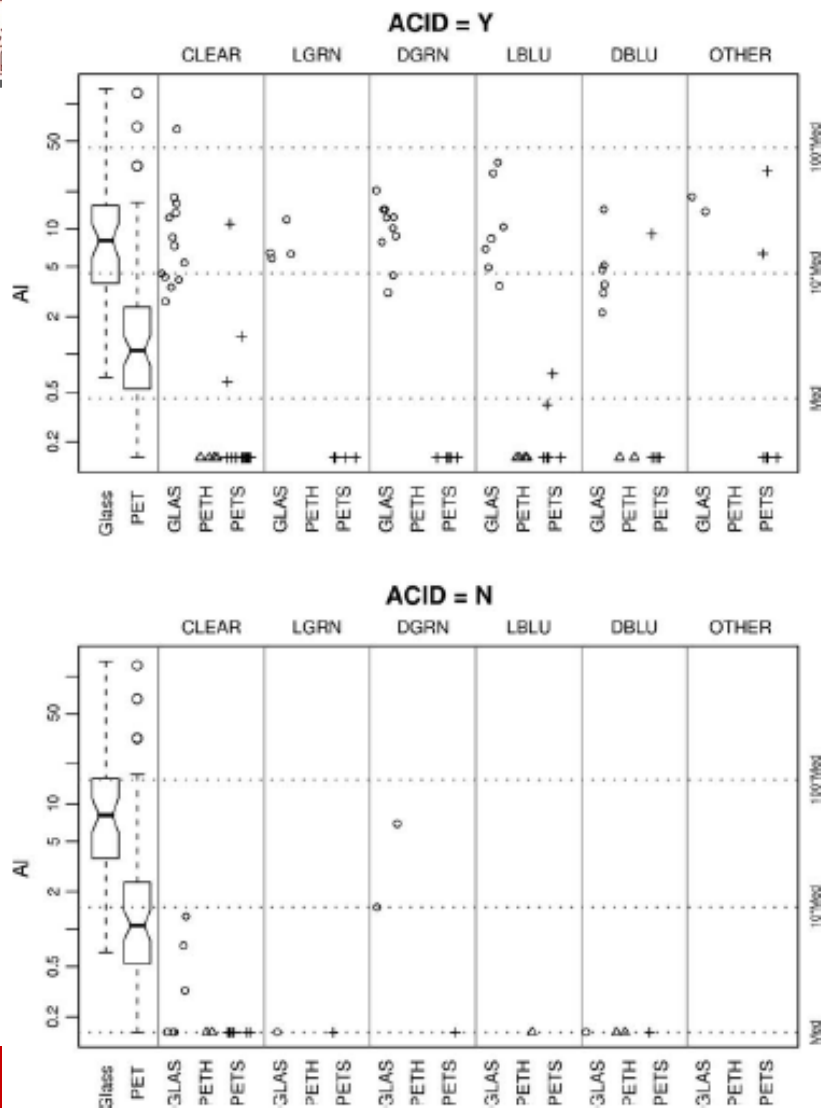
Confrontata la stessa etichetta



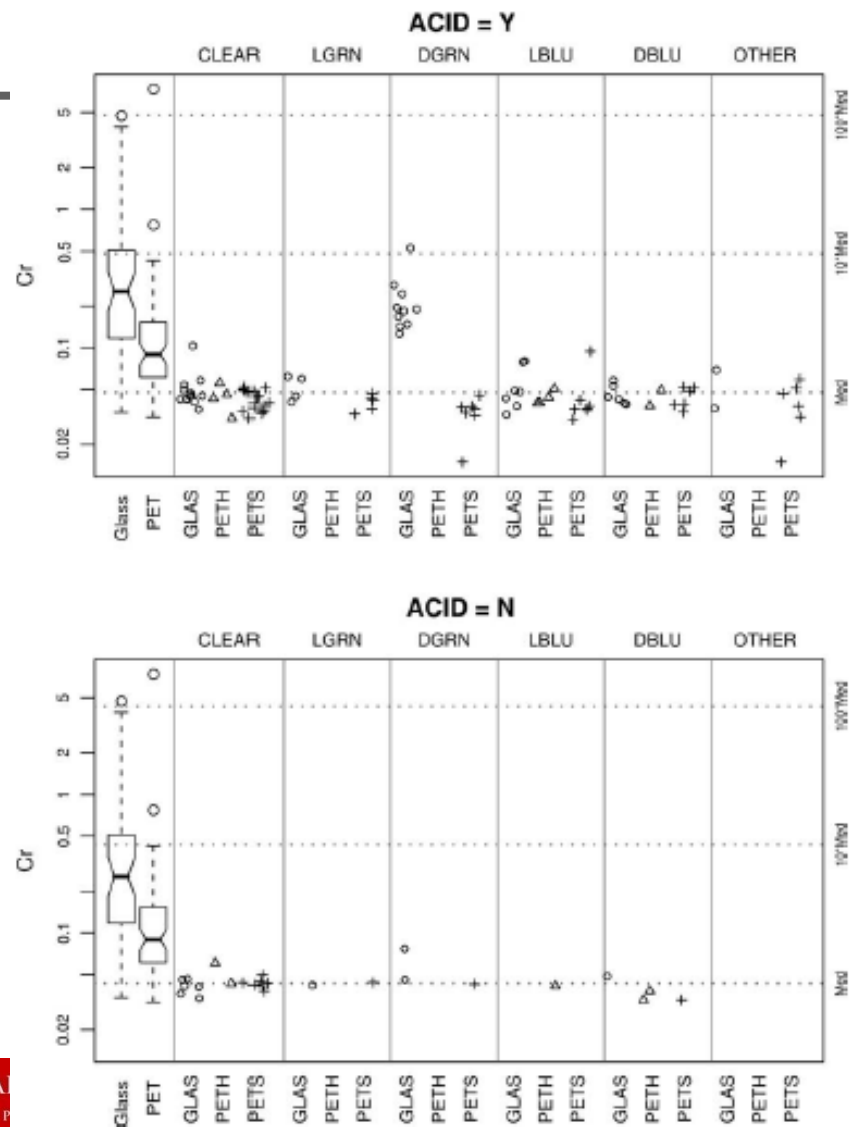
confronto dei risultati di test di lisciviazione (solo le mediane riportate) per contenitori acidificati (ACID= Y, pH 3.5) e non acidificati (ACID = N, pH 6.5) in funzione del materiale e del colore. I box plot rappresentano i risultati ottenuti sul campione totale di acque vendute sul mercato europeo

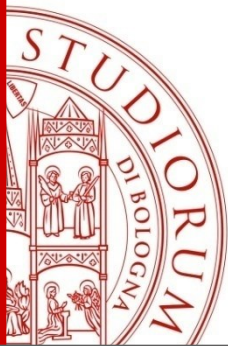
Reimann et al. (2010) – Applied Geochemistry

Alluminio



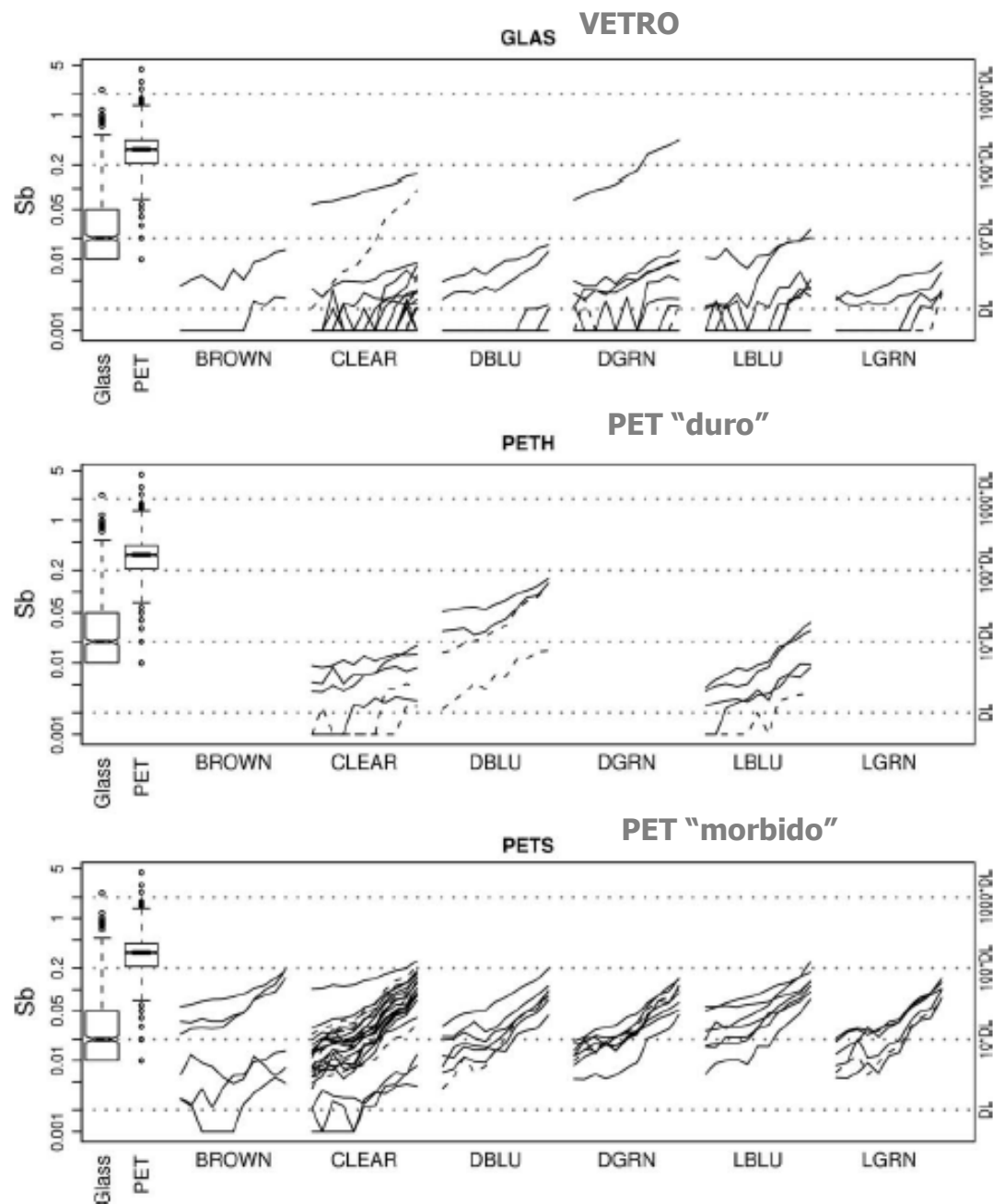
Cromo

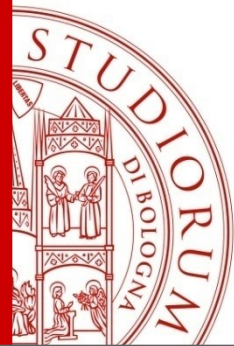




Antimonio

test di lisciviazione nel tempo per bottiglie di vetro di diverso colore in condizioni diverse di pH (pH 6.5 linea tratteggiata; pH 3.5 linea continua). Le linee uniscono misure svolte dopo 1, 2, 3, 4, 5, 15, 30, 56, 80 and 150 giorni.

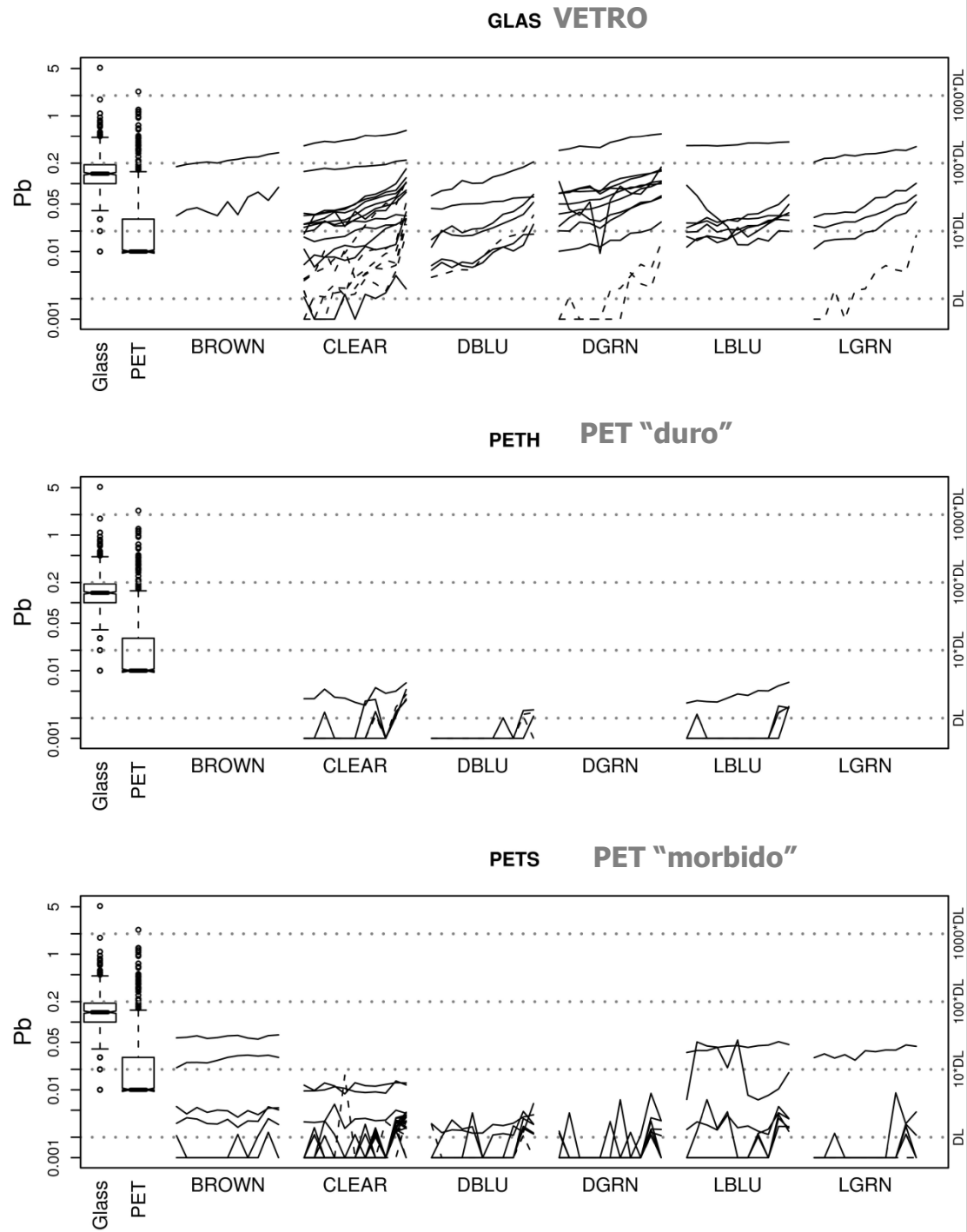


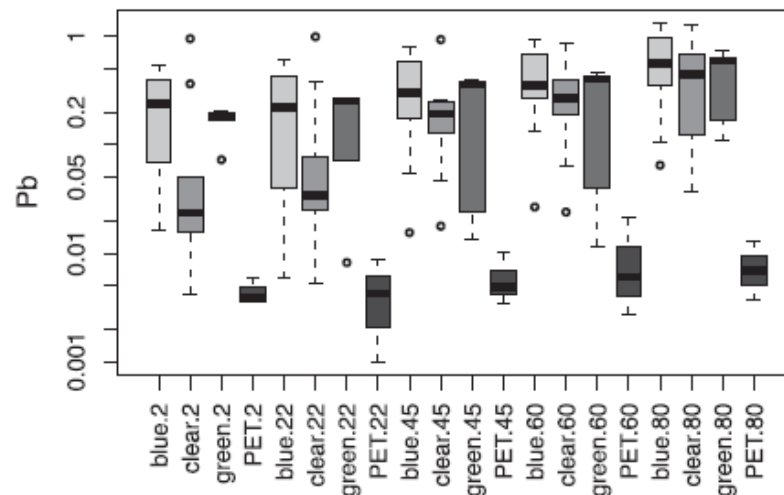
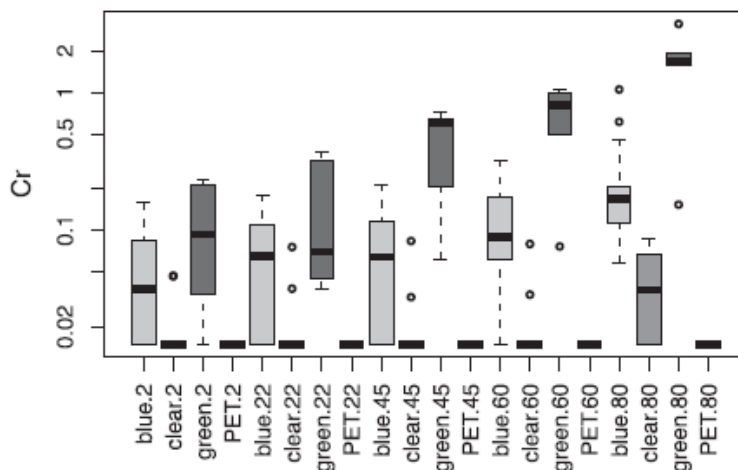
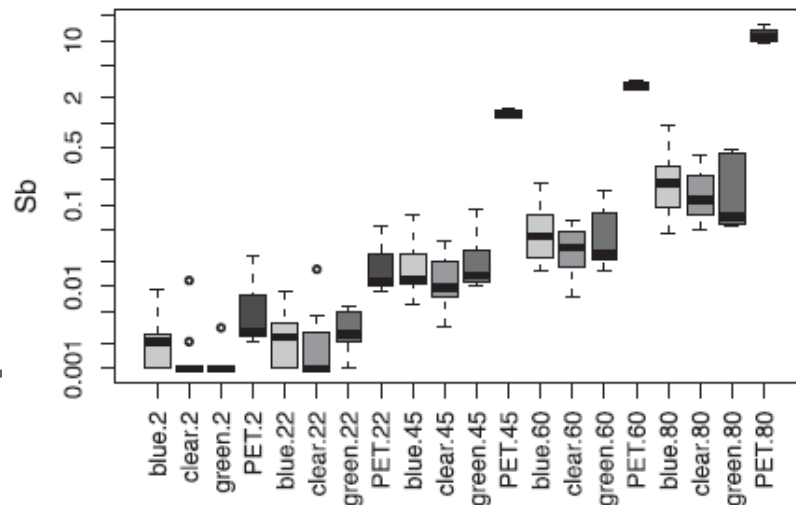
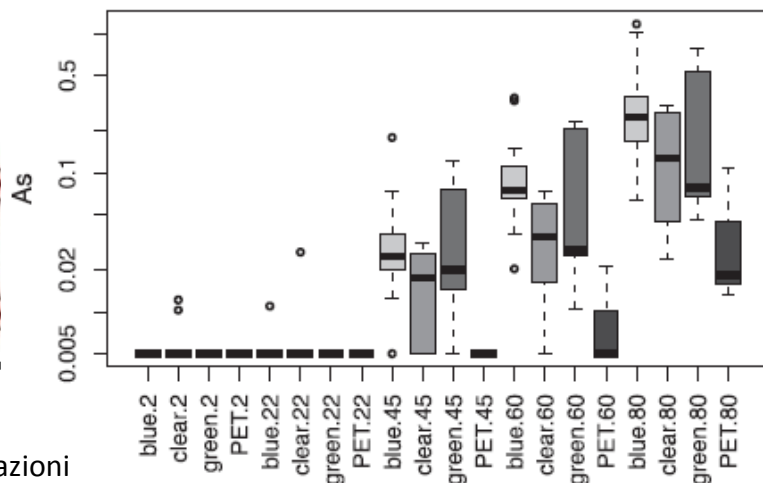
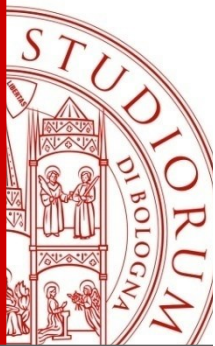


Piombo

test di lisciviazione nel tempo per bottiglie di vetro di diverso colore in condizioni diverse di pH (pH 6.5 linea tratteggiata; pH 3.5 linea continua). Le linee uniscono misure svolte dopo 1, 2, 3, 4, 5, 15, 30, 56, 80 and 150 giorni.

Reimann et al. (2010) – Applied Geochemistry

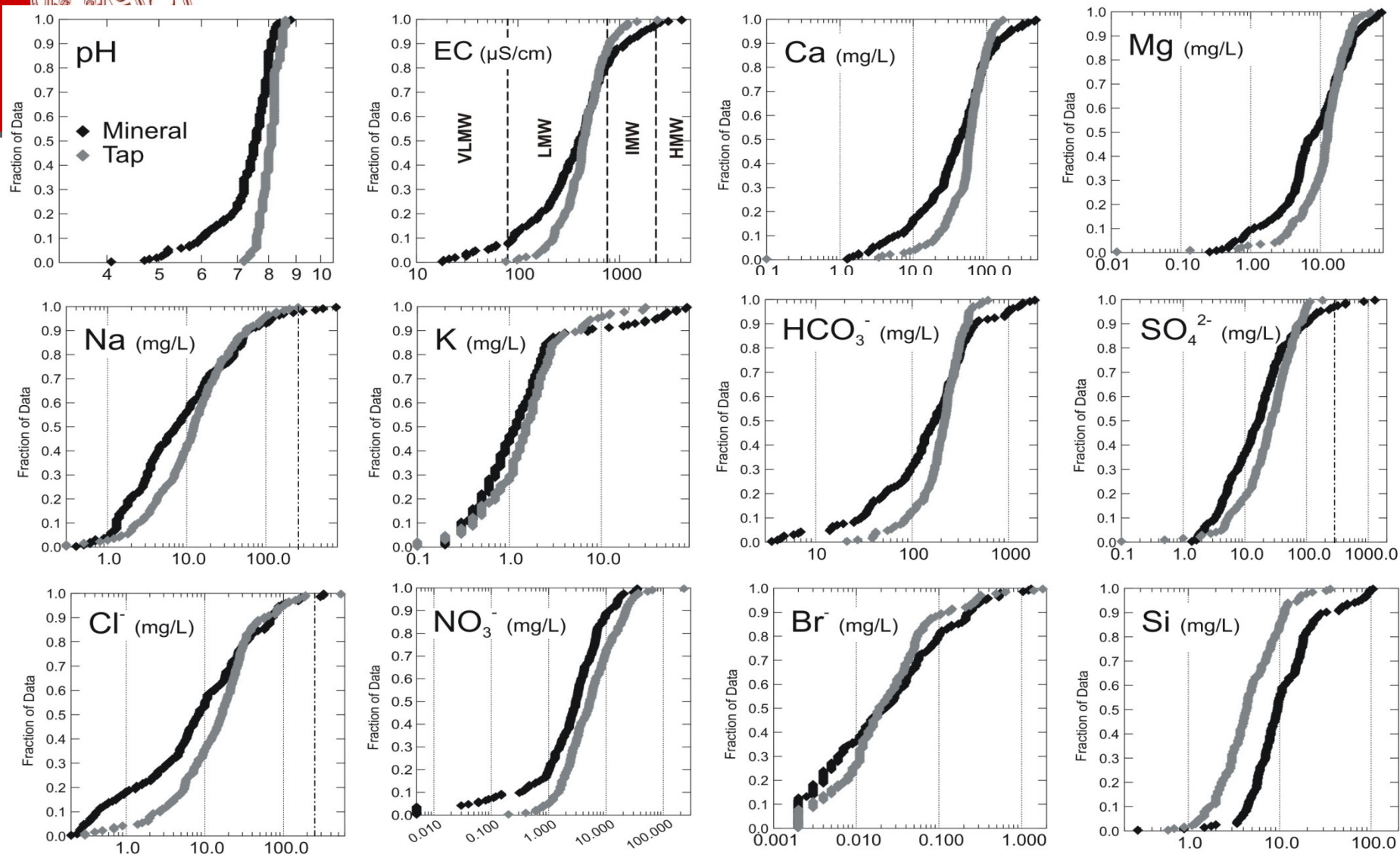


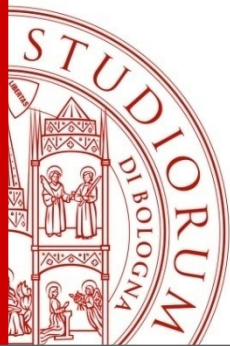


Esiste interazione tra contenitore e acqua? E della temperatura di conservazione?

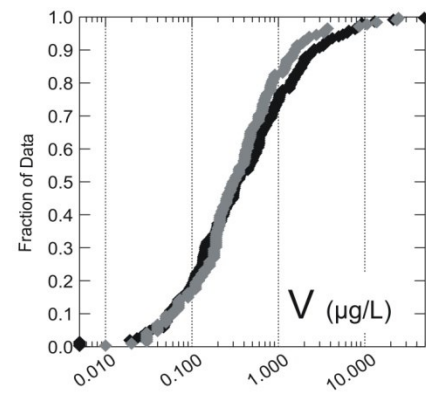
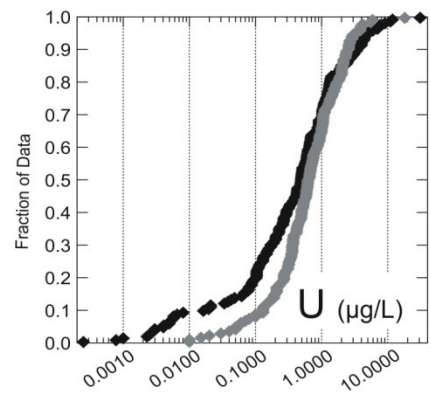
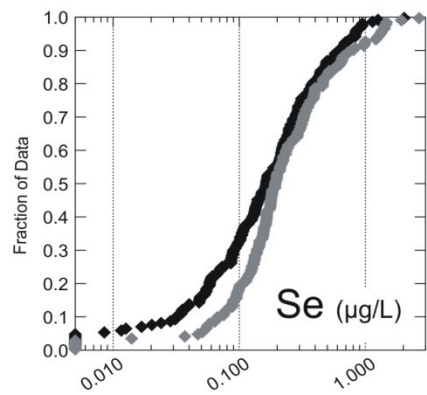
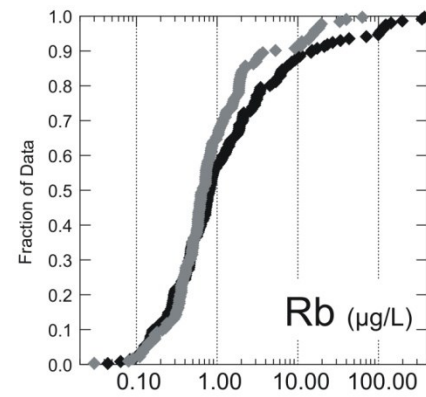
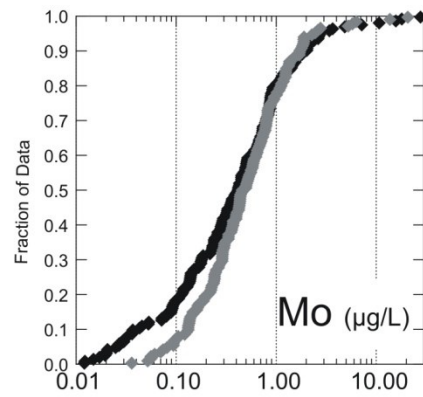
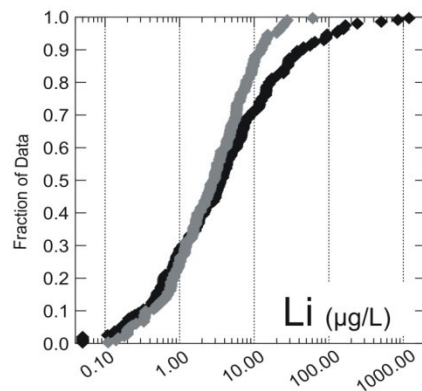
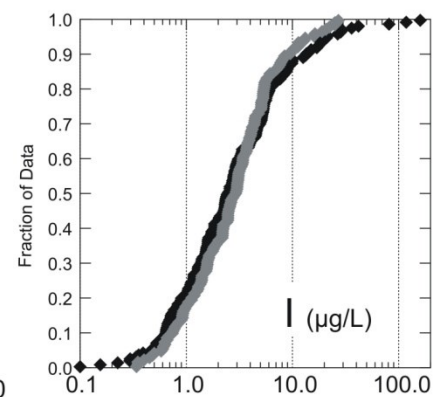
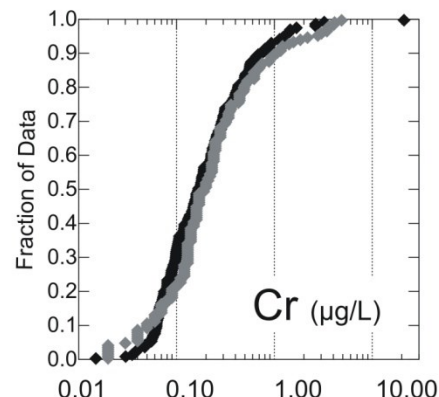
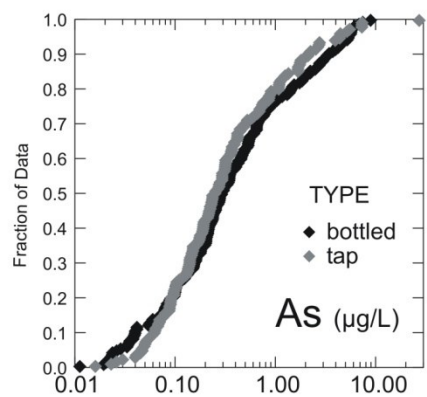
Risultati di un test durato una settimana a temperature diverse 2, 22, 45, 60, 80 °C su bottiglie di diverso tipo utilizzando acqua suprapura come reagente

Confronto tra le acque: composizione principale



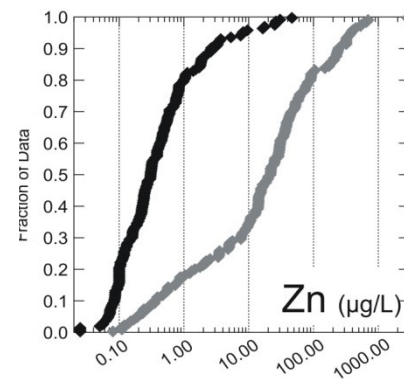
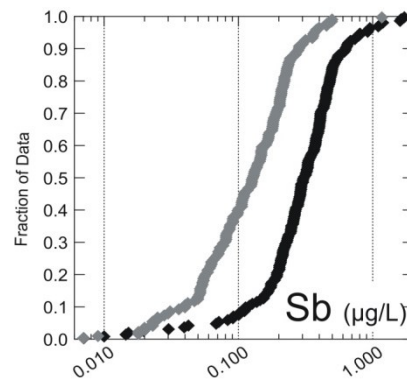
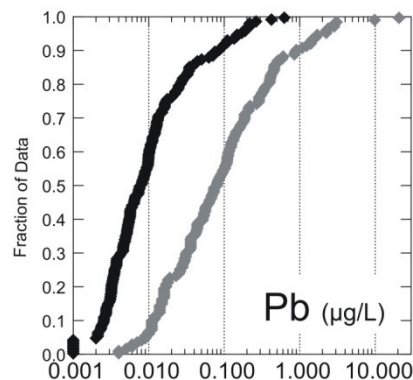
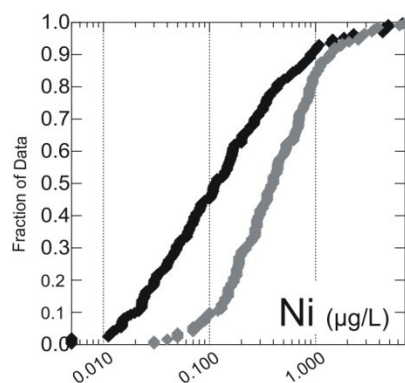
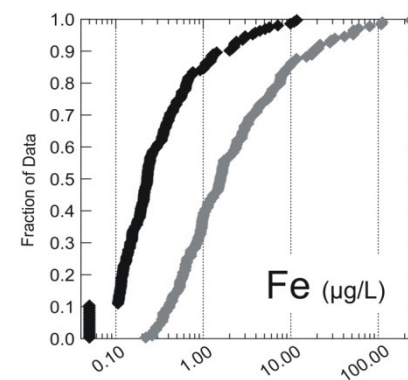
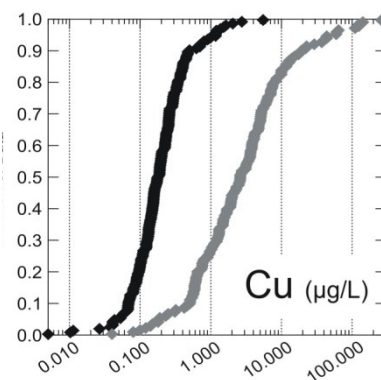
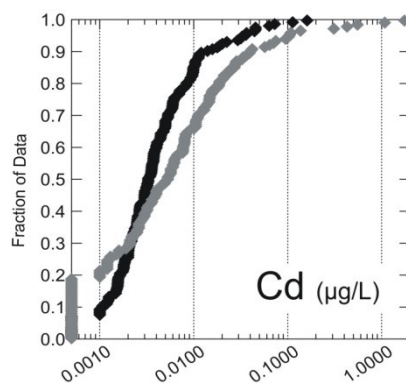
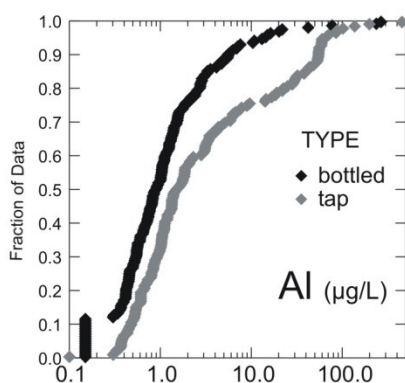


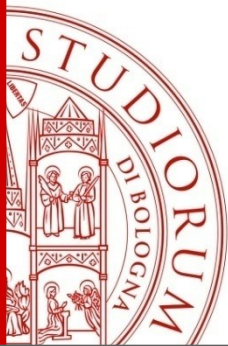
Confronto tra le acque: elementi in traccia



Il confronto tra acque potabili e acque di rubinetto

Evidente la diversa distribuzione che sono influenzati da interazione con sistemi di distribuzione





Un possibile problema: i sistemi di distribuzione

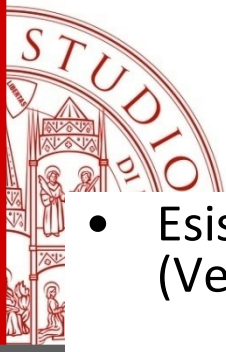
Sono possibili rilasci di componenti chimici dai materiali utilizzati nei sistemi di distribuzione.

Fenomeni di corrosione con conseguente rilascio di metalli in soluzione.

Possono essere sia legate a sistemi comuni, che relativi all'“ultimo miglio”

Tra queste

- VASCHE ACCUMULO (sedimenti che fungono da nutrimento per la carica batterica; alterazione gusto)
- TUBAZIONI e RACCORDERIA (alterazione del gusto e del colore, rilascio di metalli pesanti (Fe, Zn, Cu, Cr, Ni, ecc) dopo ristagno)
- RUBINETTI (sporco e incrostazioni calcaree possono favorire la proliferazione microbica)



Alcune considerazioni

- Esistono differenze significative tra acque conservate in diversi contenitori (Vetro e PET)
- I vetri di colore diverso hanno composizione diversa e rilasciano elementi chimici diversi
- I contenitori in PET rilasciano antimonio in quantità significative
- Esiste un rilasci differenziale funzione del tempo di contatto e della temperatura di conservazione
- Il confronto tra acque potabili e acque evidenzia che alcuni elementi hanno significative differenze (Al, Cd, Cu, Fe, Ni, Pb, Sb, Zn) legate alla interazione con il materiale delle tubature, e per l'antimonio (unico arricchito nelle acque minerali)



Inquinanti emergenti

Le Terre Rare

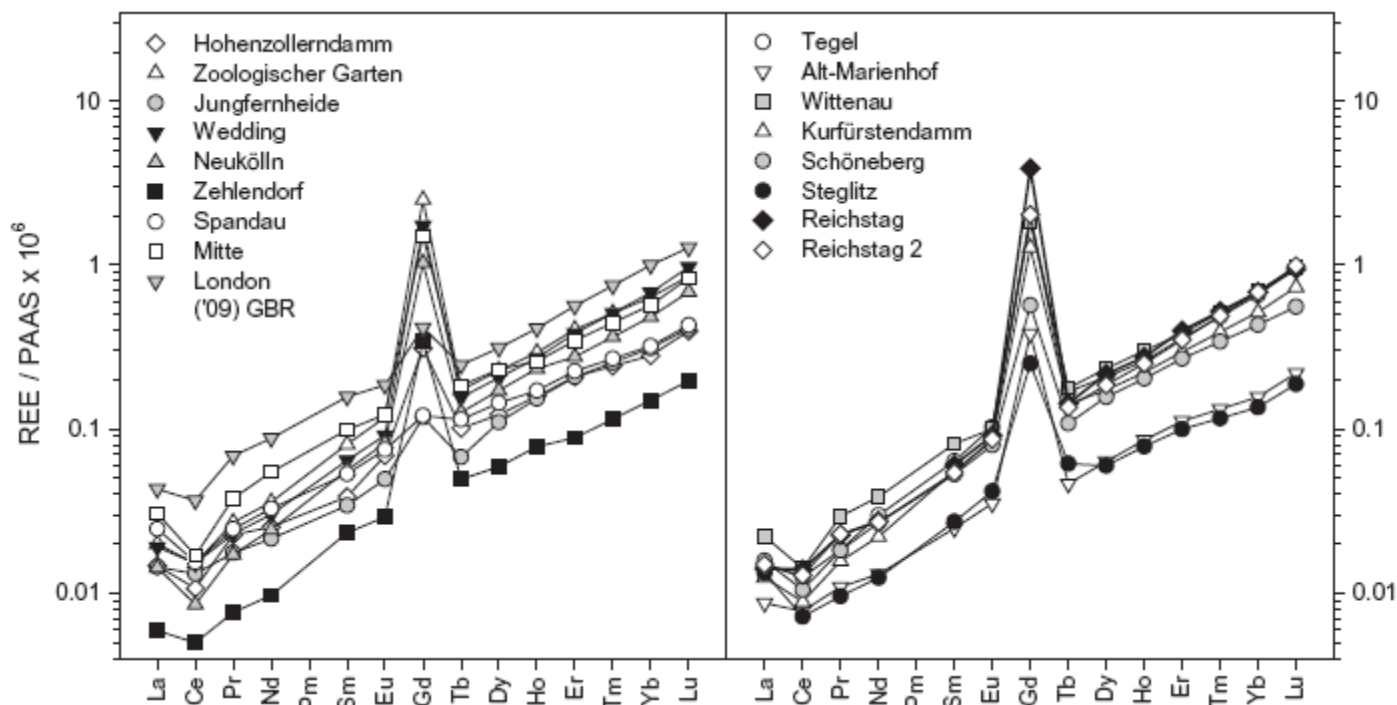
La tavola periodica

La tavola periodica

1 1IA 11A																	18 VIII A 8A				
1 H Hydrogen 1.0079	2 He Helium 4.00260																				
3 Li Lithium 6.941	4 Be Beryllium 9.01218															5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.998403	10 Ne Neon 20.1797
11 Na Sodium 22.989768	12 Mg Magnesium 24.305	13 Al Aluminum 26.981539	14 Si Silicon 28.0855	15 P Phosphorus 30.973762	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948														
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.95591	22 Ti Titanium 47.88	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.64	33 As Arsenic 74.92159	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80				
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium 98.9072	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.90447	54 Xe Xenon 131.29				
55 Cs Cesium 132.90543	56 Ba Barium 137.327	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.9665	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98037	84 Po Polonium [208.9824]	85 At Astatine 209.9871	86 Rn Radon 222.0176				
87 Fr Francium 223.0197	88 Ra Radium 226.0254	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Uuq Ununquadium [289]	115 Uup Ununpentium unknown	116 Uuh Ununhexium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown				
Lanthanide Series			57 La Lanthanum 138.9055	58 Ce Cerium 140.115	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium 144.9127	62 Sm Samarium 150.36	63 Eu Europium 151.9655	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967				
Actinide Series			89 Ac Actinium 227.0278	90 Th Thorium 232.0381	91 Pa Protactinium 231.03588	92 U Uranium 238.0289	93 Np Neptunium 237.0482	94 Pu Plutonium 244.0642	95 Am Americium 243.0614	96 Cm Curium 247.0703	97 Bk Berkelium 247.0703	98 Cf Californium 251.0796	99 Es Einsteinium [254]	100 Fm Fermium 257.0951	101 Md Mendelevium 258.1	102 No Nobelium 259.1009	103 Lr Lawrencium [262]				
			Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetals	Nonmetals	Halogens	Noble Gas	Lanthanides	Actinides									

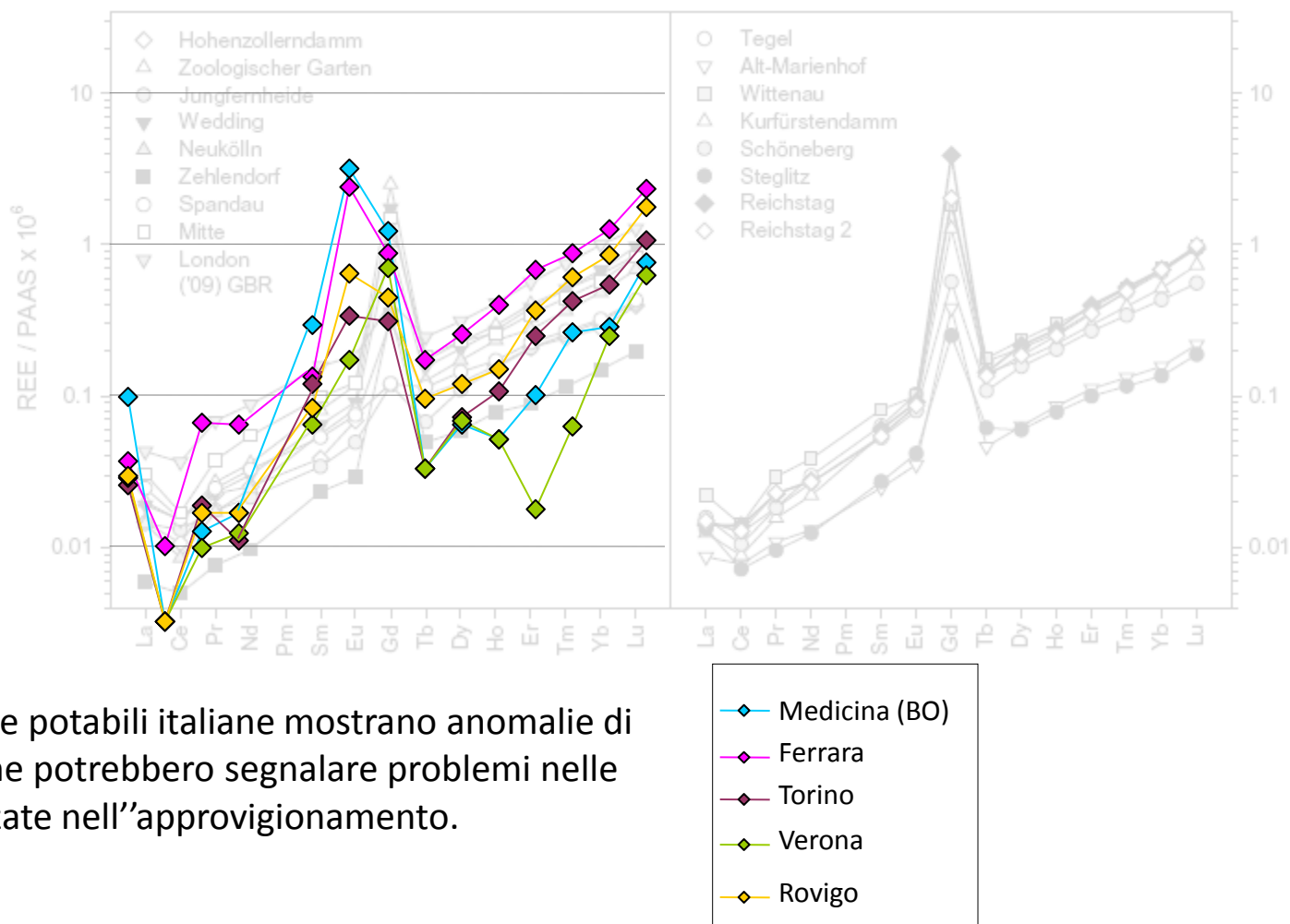
Inquinanti emergenti

Le Terre Rare – il Gadolinio

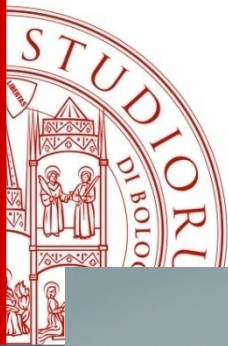


Forte anomalia di Gadolinio osservata in acque distribuite in diverse località a Berlino (riportato anche un campione da Londra):
Quasi tutti i campioni mostrano una anomalia nell'elemento

Le Terre Rare – il Gadolinio

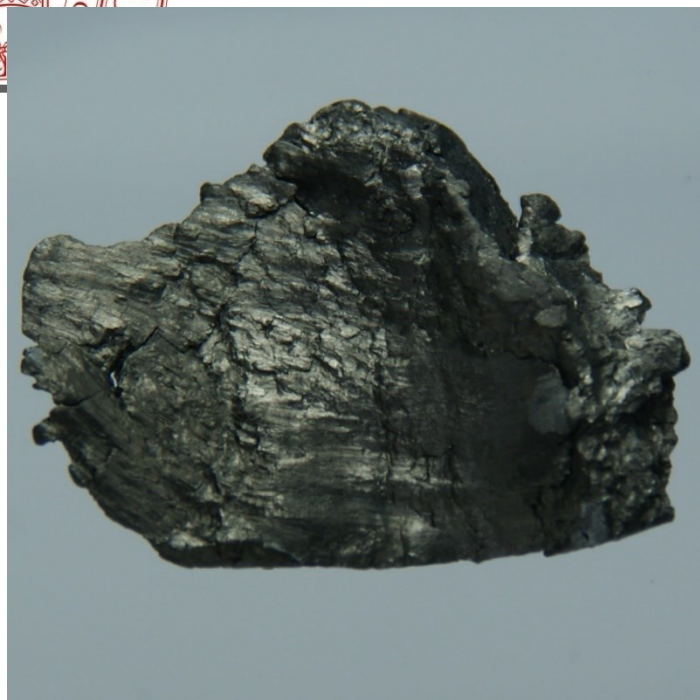


Alcune acque potabili italiane mostrano anomalie di Gadolinio che potrebbero segnalare problemi nelle acque utilizzate nell'approvvigionamento.



Inquinanti emergenti

Le Terre Rare – il gadolinio



Elemento piuttosto raro sulla terra
(0.00052% della crosta terrestre)

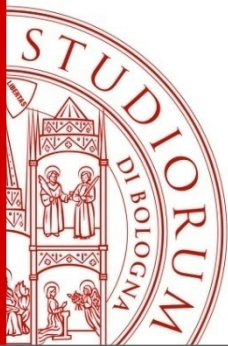
Gli impianti di depurazione non sono in grado di eliminare questo elemento, che nelle acque reflue raggiunge concentrazioni molto elevate.

Non sono note origini naturali in grado di originare anomalie simili



Composti di Gadolinio (chelati) sono utilizzati come agenti di contrasto in medicina (risonanza magnetica)

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*UN GRAZIE AGLI AMICI E AI COLLEGHI CHE HANNO
CONTRIBUITO ALLA RACCOLTA E ALLA CAMPIONATURA
DELLE ACQUE*

Geochemistry of European Bottled water



Borntraeger
Science Publishers



Birke M., Demetriades A., De Divo B.
(eds), 2010. Mineral waters of Europe.
Special Issue of Journal of Geochemical
Exploration, 107 (3)

De Vivo B., Birke M., Cicchella D., Giaccio L.,
Dinelli E., Lima A., Albanese S., Valera P., 2010.
Acqua di casa nostra. Le Scienze, dicembre 2010,
506.

Journal of Geochemical Exploration
journal homepage: www.elsevier.com/locate/jgeoexp

Hydrogeochemical analysis on Italian bottled mineral waters: Effects of geology
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ABSTRACT
The use of bottled mineral waters is increasingly becoming popular and the need for better knowledge of their chemical composition is a key issue for defining their quality, particularly for those elements that are not mentioned on regular labels. The link between geology and water chemistry is well known and can lead to extreme differences in element distribution and is an issue that needs to be addressed. Such an opportunity has been provided by a project of the EuroGeochem Geochemistry Expert Group aimed at the characterization of groundwater geochemistry using bottled mineral waters purchased in representative all over Europe. On these waters pH, conductance and concentrations of 60 elements and ions were measured at the IGC Geochemical laboratories. On a total of 1700 "samples", 1500 samples were bottled in Italy in 126 different sites scattered throughout the country. Most of the purchased mineral water is packaged in PET bottles. In this paper, the dataset concerning Italy has been used to provide an overview on the relationship between natural occurrence of the determined chemical elements in groundwater and geochemical features. These relationships have been investigated mostly relying on accurate surface geology and other information available on water sources. Application of B-mode factor analysis to the data set allowed the determination of the possible relationship between the distribution of individual elements and lithology or other natural enrichment phenomena. In particular waters draining volcanic rocks are enriched in elements such as B, Br, Cl, Cr, K, Li, Na, NO₃⁻, PO₄³⁻, Rb, Sr, SiO₂, Fe, Ti, and V to 10³ or 10⁴ times of magnitude higher than waters draining other lithologies. REE and T₂ show significant differences in median concentrations due to interaction of waters with plutonic rocks. Many elements have a large spread of concentrations, which reflects natural variations and increases with specific lithologies. One of the B-mode factor analysis associations, recognized as being representative of elements analyzed shows high nitrate and V loadings along with As, NO₃⁻ and Fe. The latter association probably reflects a sign of anthropogenic contribution in some aquifers in volcano-sedimentary or silico-clastic deposits and in intensively cultivated areas.

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1. Introduction
Consumption of bottled mineral water is increasing significantly worldwide, becoming an important factor both in economic and health issues. This is particularly true in Italy, since the country is one of the largest producers (over 12 billion Litres) and consumers (200 Litres, on average) of bottled water in the world (Borntraeger, 2008). The need for bottled water for nutrition and health was initiated by the Romans and some well known springs used in ancient times are still exploited today (Gongg, 2001). The production of bottled groundwater in Italy increased by 30% over the last 5 years and remained constant between 2007 and 2008. In Italy, there are 415 official brands according to the European Directive 2003/84/EC.

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SALUTE PUBBLICA

Che acqua beviamo?

I risultati di un'indagine sulle acque minerali indicano che urgono nuove regole per fissare i limiti di alcune sostanze dannose per la salute

di Annamaria Lima, Domenico Cicchella, Lucia Giaccio, Enrico Dinelli, Stefano Albanese, Paolo Valera e Benedetto De Vivo

Journal of Geochemical Exploration
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Trace elements and ions in Italian bottled mineral waters: Identification of anomalous values and human health related effects
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ABSTRACT
Microbiological studies have always had an important role in the evaluation of drinking water quality. However, since geological processes are the most important factors controlling the source and distribution of chemical elements in natural waters, the importance of geochemical data must not be underestimated. This study presents data on pH, conductance and concentrations of 60 elements and ions in 150 different brands available on the Italian market (Fig. 1 and Table 1). This work is part of a European project aimed at studying and characterizing the geochemistry of 1700 European mineral bottled waters of different brands carried out by the EuroGeochem Geochemistry Expert Group (Borntraeger and others, 2010).

Italy are the main consumers and producers of bottled mineral waters in the world. In the last few years national mineral water production has grown up to 12 billion litres, with an annual turnover value of almost 3 billion euro. Almost half of the Italian population prefers bottled water to tap water and on average every inhabitant drinks more than half a litre per day (2001 per capita per annum).

More than 300 different brands of mineral water are present on the Italian market (IJC, 1998, 2001). However, Italy counts a country rich in natural and usually very high quality springs which are connected to aquifers and used for the distribution of tap water. Various market surveys show that in age characterized by heavy chemical pollution, consumers will consider bottled waters pure, unadulterated and a symbol of good health. However, even if bottled water quality is good, we should not forget that it can still carry natural contamination from small amounts of potentially harmful elements that can be present in the spring.

In Italy mineral waters are classified on the basis of their residue (i.e. amount of mineral salt obtained after drying at 180 °C): 1) mineral water lightly mineralized (<50 mg/L); 2) oligomineral water (50–500 mg/L); 3) medium-mineral water (500–1000 mg/L); 4) water rich in minerals (>1000 mg/L). Waters with a total mineral up to 1000 mg/L are strongly mineral waters and their therapeutic properties are widely recognized. Mineral water highly mineralized may be above 15% of all the mineral waters on the Italian market, while oligomineral water makes up 65% and medium-mineral 20%. Waters rich in mineral salts (15% of the market share) are defined as medicinal waters.

Usually only major elements concentrations are reported on the labels, while trace elements are ignored. As long as the mineral water is consumed in limited amounts or for short periods of time they may not constitute a problem, but this may not be the case of consumption

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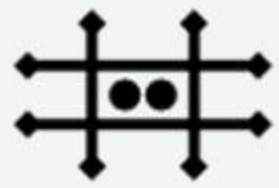
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Zn Sn
Cu
Ag Mo
Ni Pb

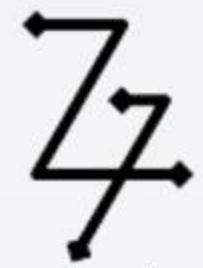
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zinco



piombo



argento



bismuto



stagno



platino



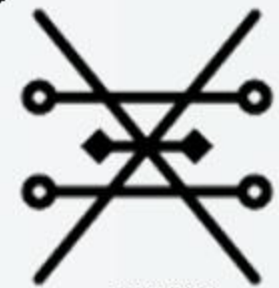
ferro



antimonio



zolfo



rame



oro



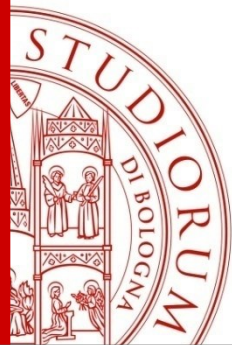
mercurio



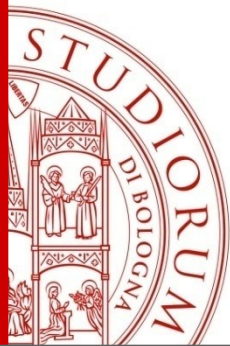
arsenico



Risultati di analisi di confronto tra acque di rubinetto trattate con: Caraffe filtranti, impianti a osmosi inversa, addolcitori

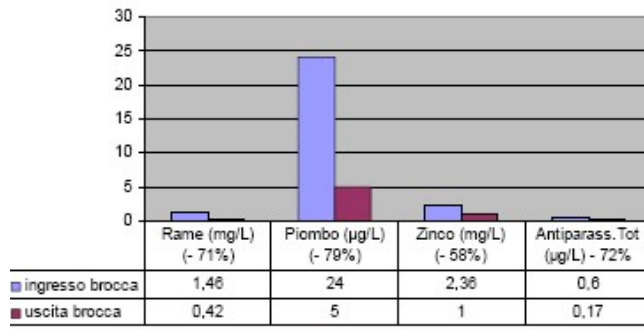


località	tipo	pH	C.E [μS/cm]	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	HCO3 mg/l	F mg/l	Cl mg/l	Br mg/l	NO3 mg/l	SO4 mg/l
CARAFFA FILTRANTE													
Cento	rubinetto	7.55	397.9	63.8	13.0	15.2	2.8	237.9	0.09	22.2	0.16	7.9	44.4
Cento	caraffa	7.66	399.9	38.7	27.6	15.2	3.1	225.7	0.09	22.4	0.15	7.2	44.4
Fano	rubinetto	7.8	544.0	77.2	14.6	4.8	2.7	256.2	0.19	26.7	0.49	3.4	62.7
Fano	caraffa	6.9	486.0	46.3	14.0	27.9	5.1	134.2	0.21	41.9	0.43	5.5	84.8
Ravenna	rubinetto	7.76	749.0	87.8	18.3	48.8	6.3	237.9	0.11	67.4		4.2	78.5
Ravenna	caraffa	6.93	104.9	8.1	2.2	10.9	1.0	39.0	0.02	12.5		1.4	1.0
Imola	rubinetto	7.15	936.0	136.2	31.0	35.0	3.8	397.7		42.1		21.4	87.4
Imola	caraffa	7.31	945.0	137.6	31.6	35.5	3.5	405.0	0.30	40.6		23.6	80.8
DEPURATORE													
Ravenna	rubinetto	7.75	768.0	86.0	18.6	51.4	6.6	239.1	0.18	69.4		4.2	80.6
Ravenna	depuratore	6.36	42.8	2.4	0.4	6.1	0.6	13.4		5.2		1.7	1.3
Treviso	rubinetto	8.2	434.0	55.3	21.9	2.7	0.8	232.0	0.07	4.3		7.1	45.9
Treviso	depuratore	7.2	18.5	1.6	0.5	0.3	0.0	4.6		0.4		0.6	1.8
ADDOLCITORE													
Ravenna	rubinetto	7.7	565.0	61.3	14.3	29.6	5.6	240.0	0.10	40.7	0.20	4.6	56.7
Ravenna	addolcitore		595.0	3.4	0.1	134.0	0.4	222.0	33.40	0.1	0.04	4.6	53.0
Reggio Emilia	rubinetto	7.13	703.6	135.1	15.2	19.3	1.8	433.1	0.28	35.1		22.6	49.8
Reggio Emilia	addolcitore	7.2	699.0	34.0	4.0	141.0	1.8	439.2	0.08	31.6		21.7	50.1

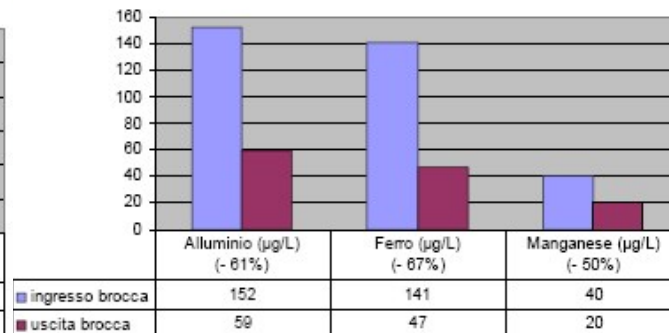


Effetto della filtrazione su brocca

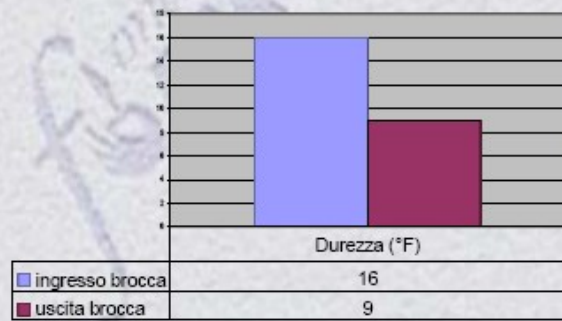
parametri chimici



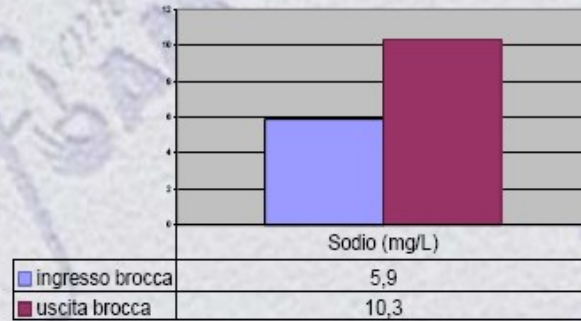
parametri indicatori



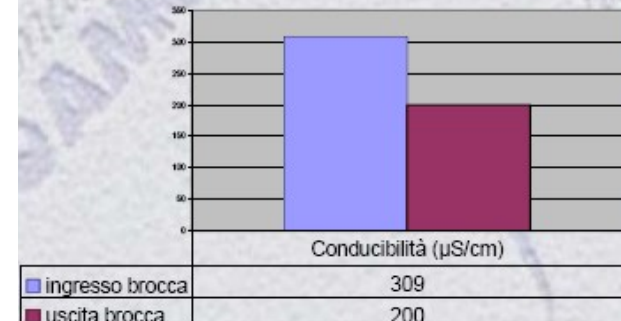
parametro durezza (- 43,7%)

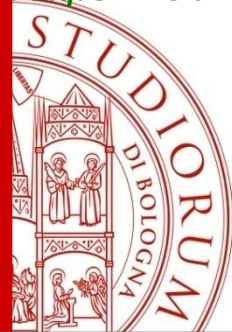


parametro sodio (+ 74,6%)

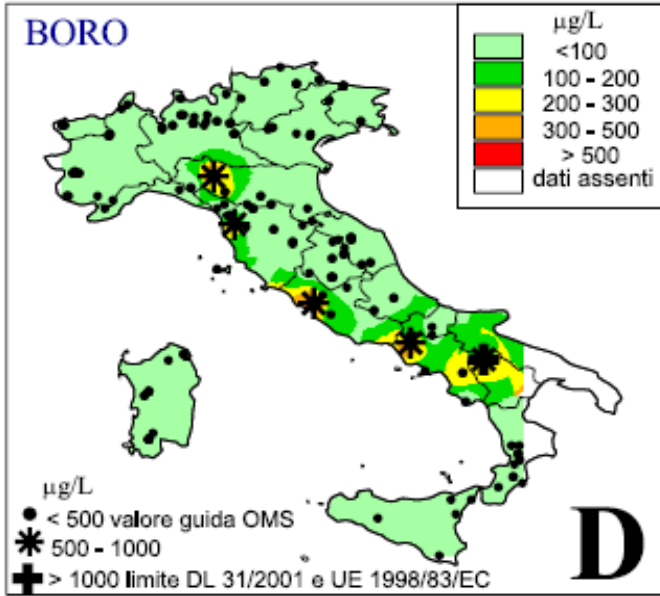
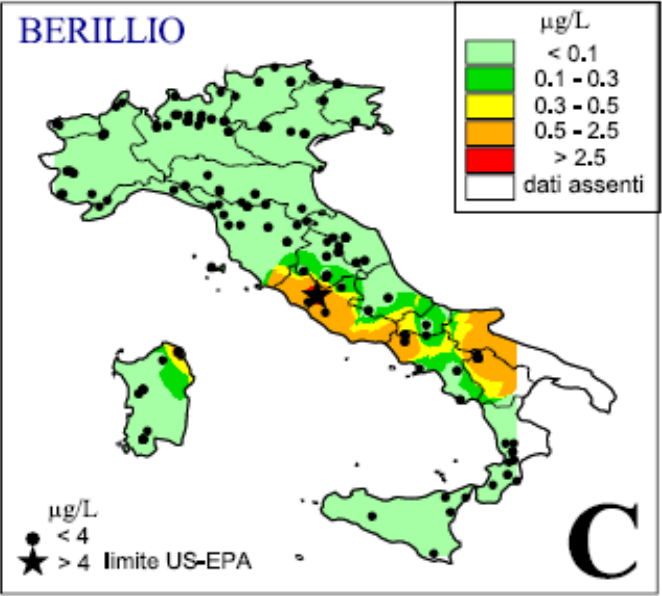
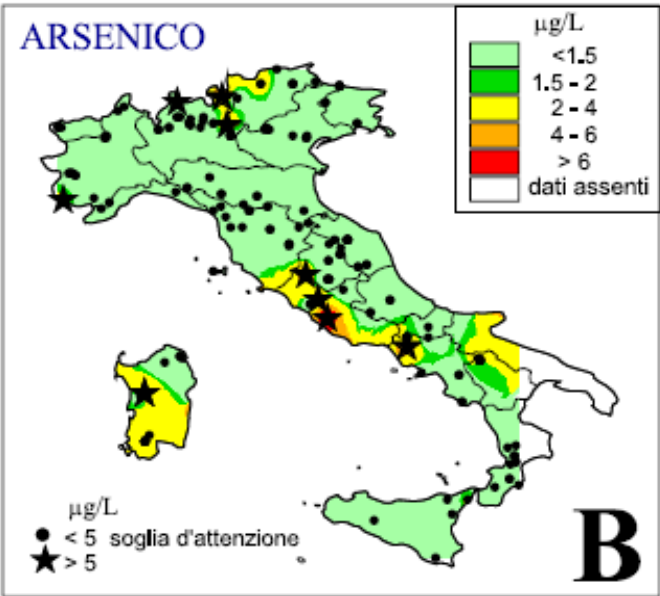
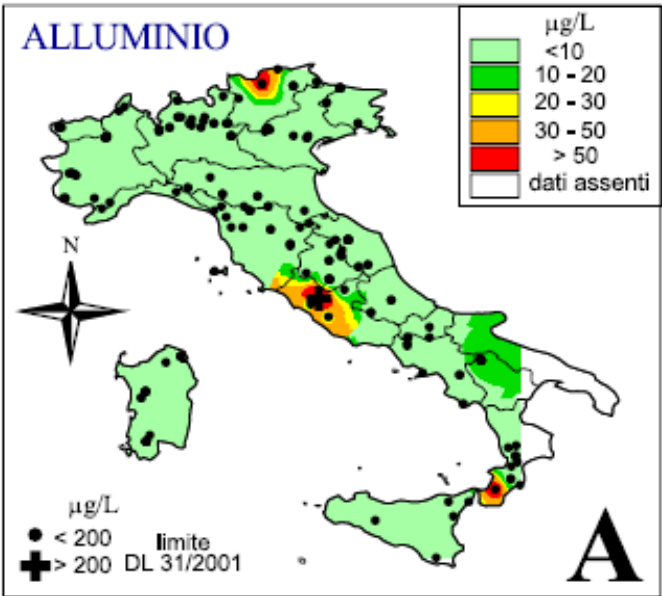


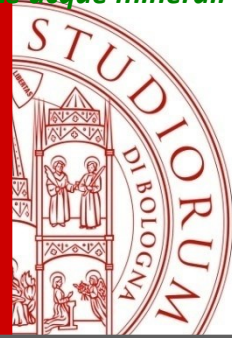
parametro conducibilità (- 35%)



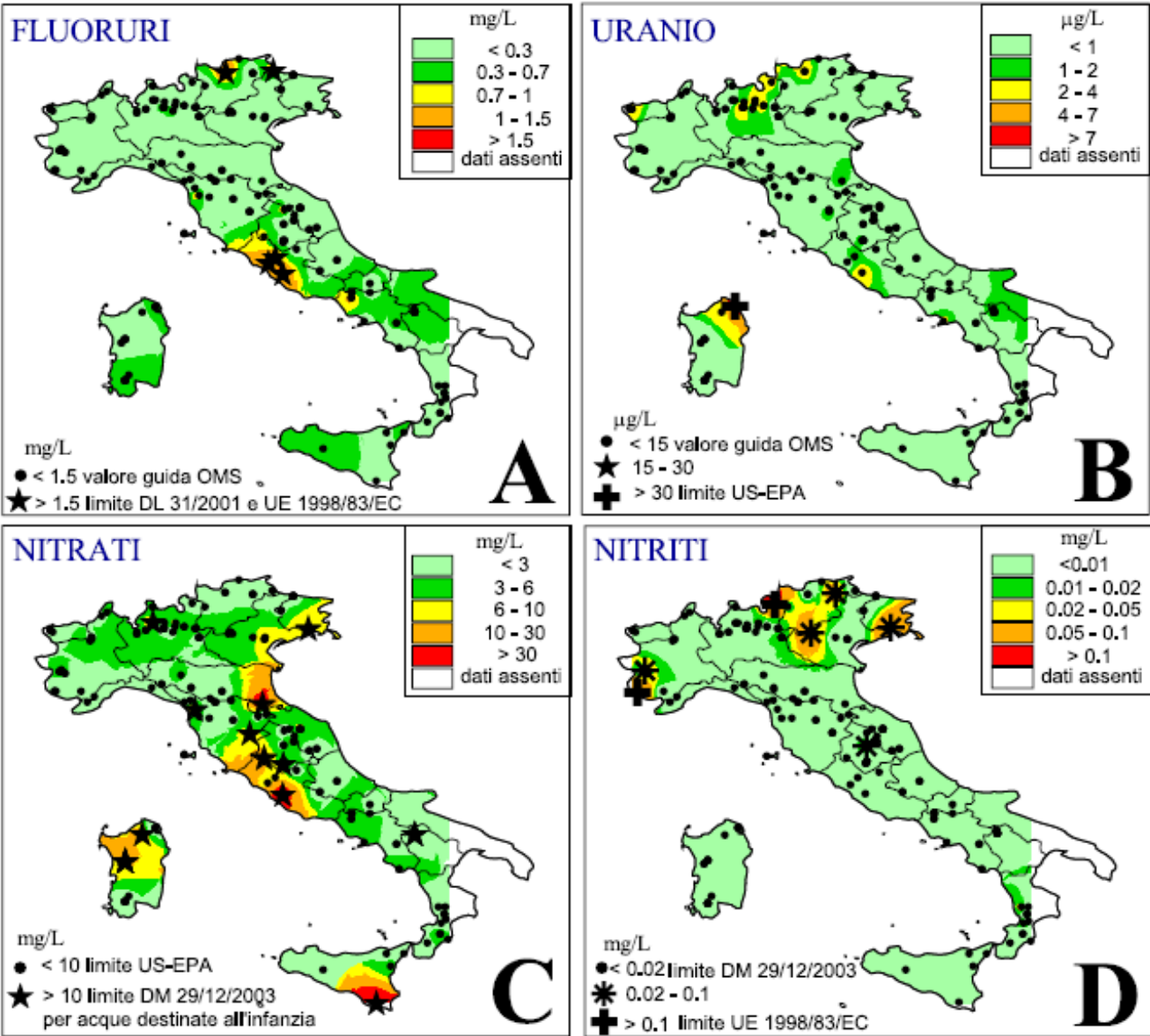


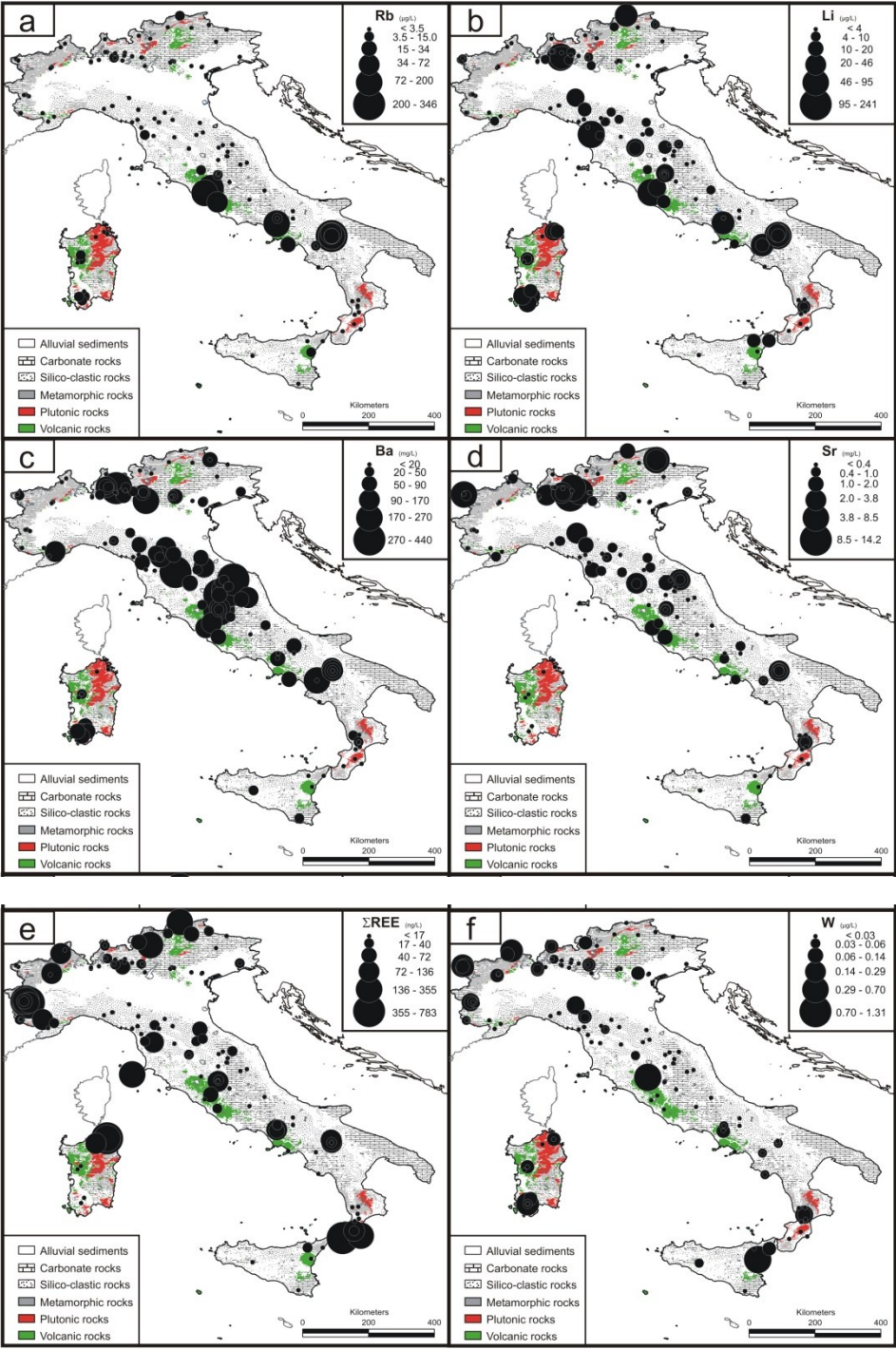
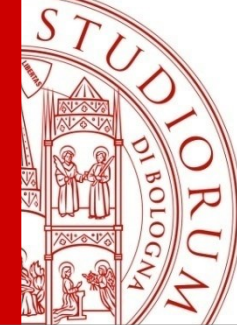
Alcuni elementi di interesse ambientale

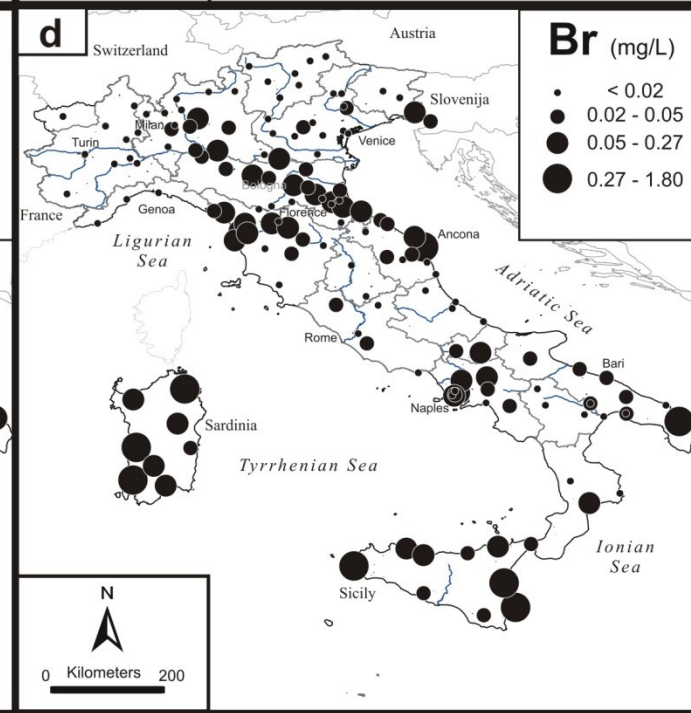
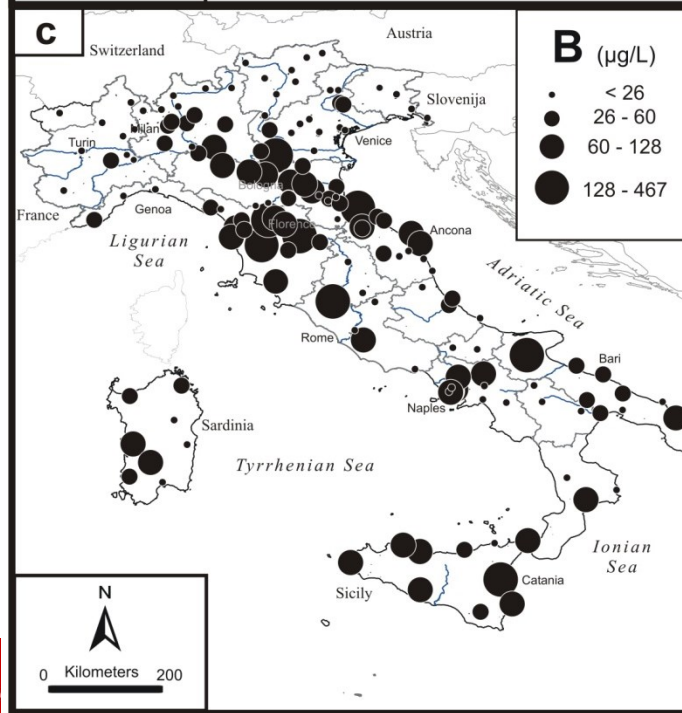
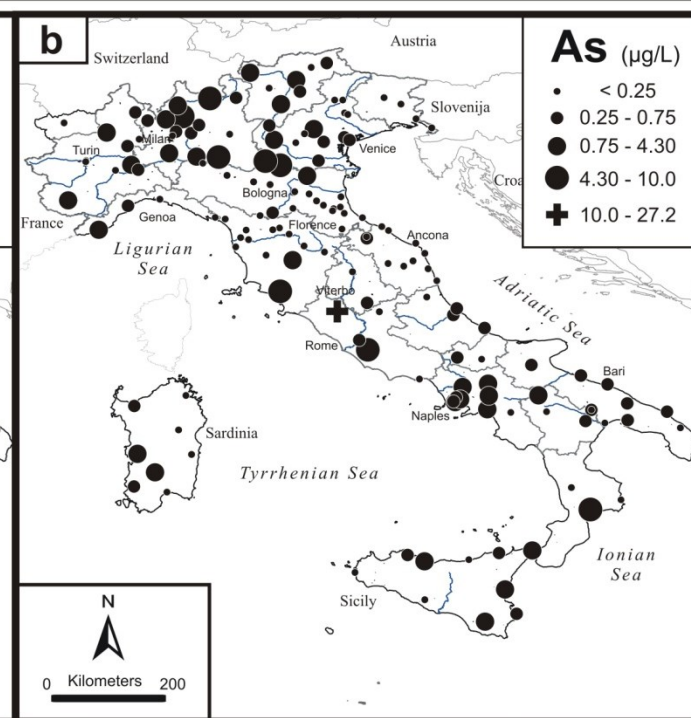
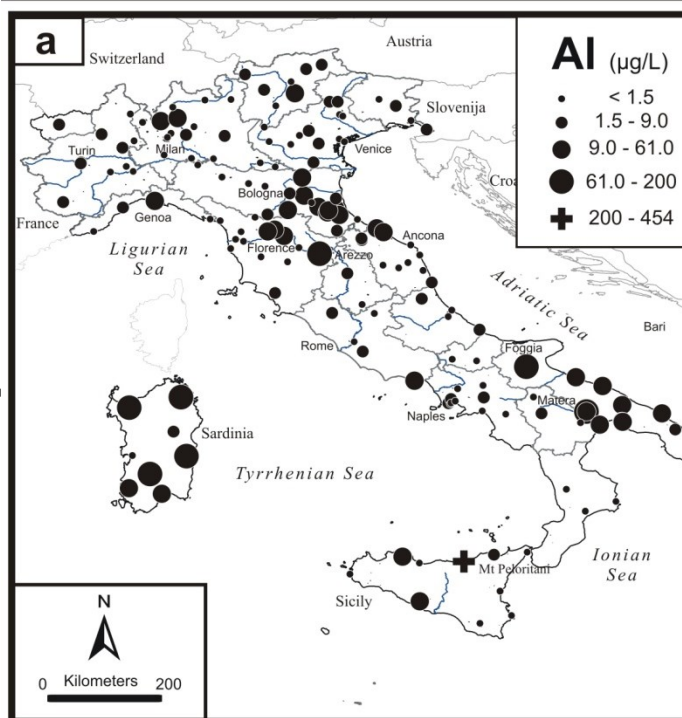
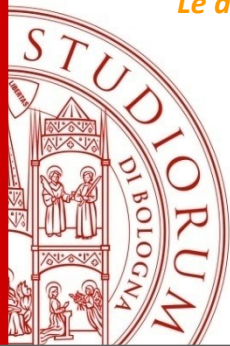


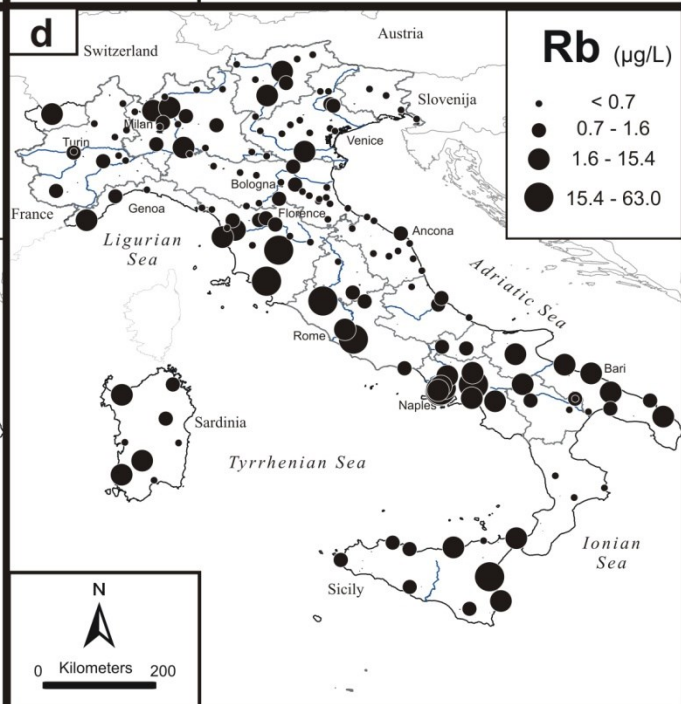
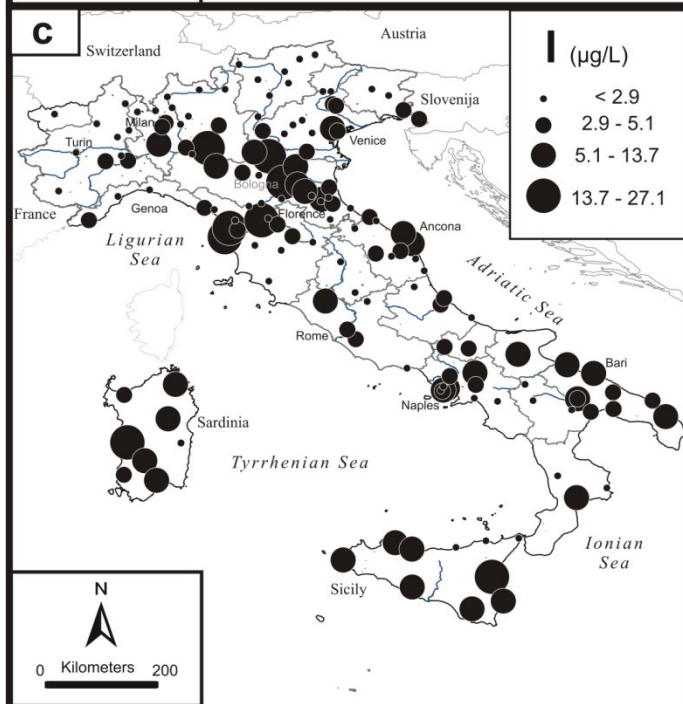
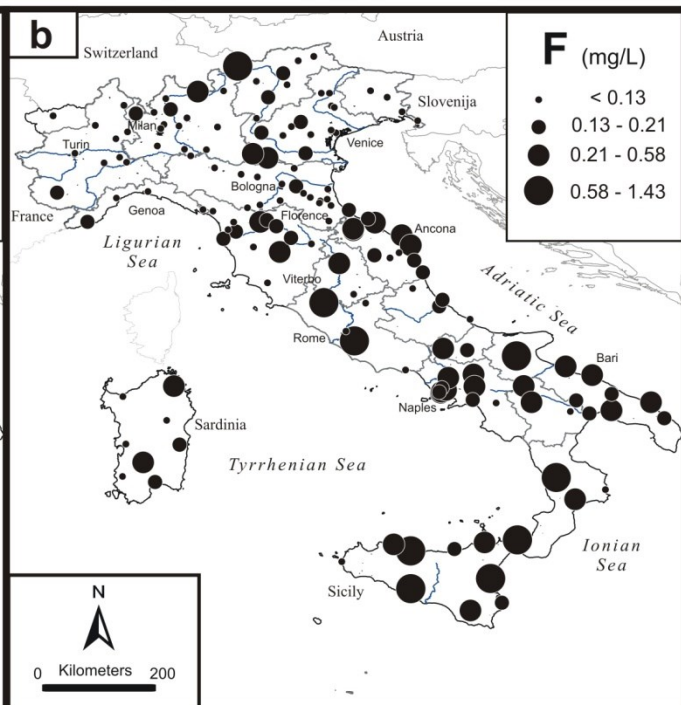
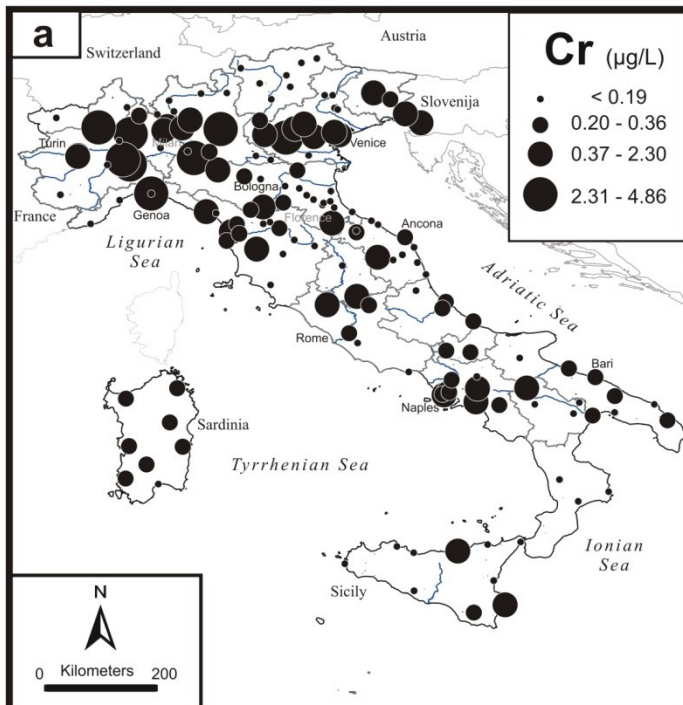
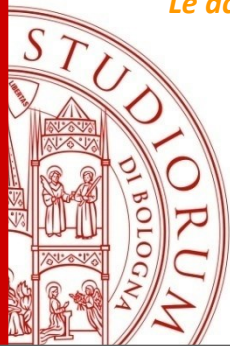


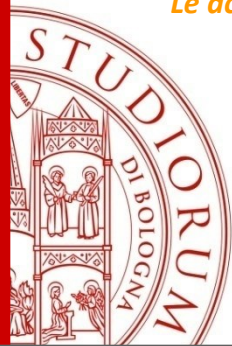
Alcuni elementi di interesse ambientale



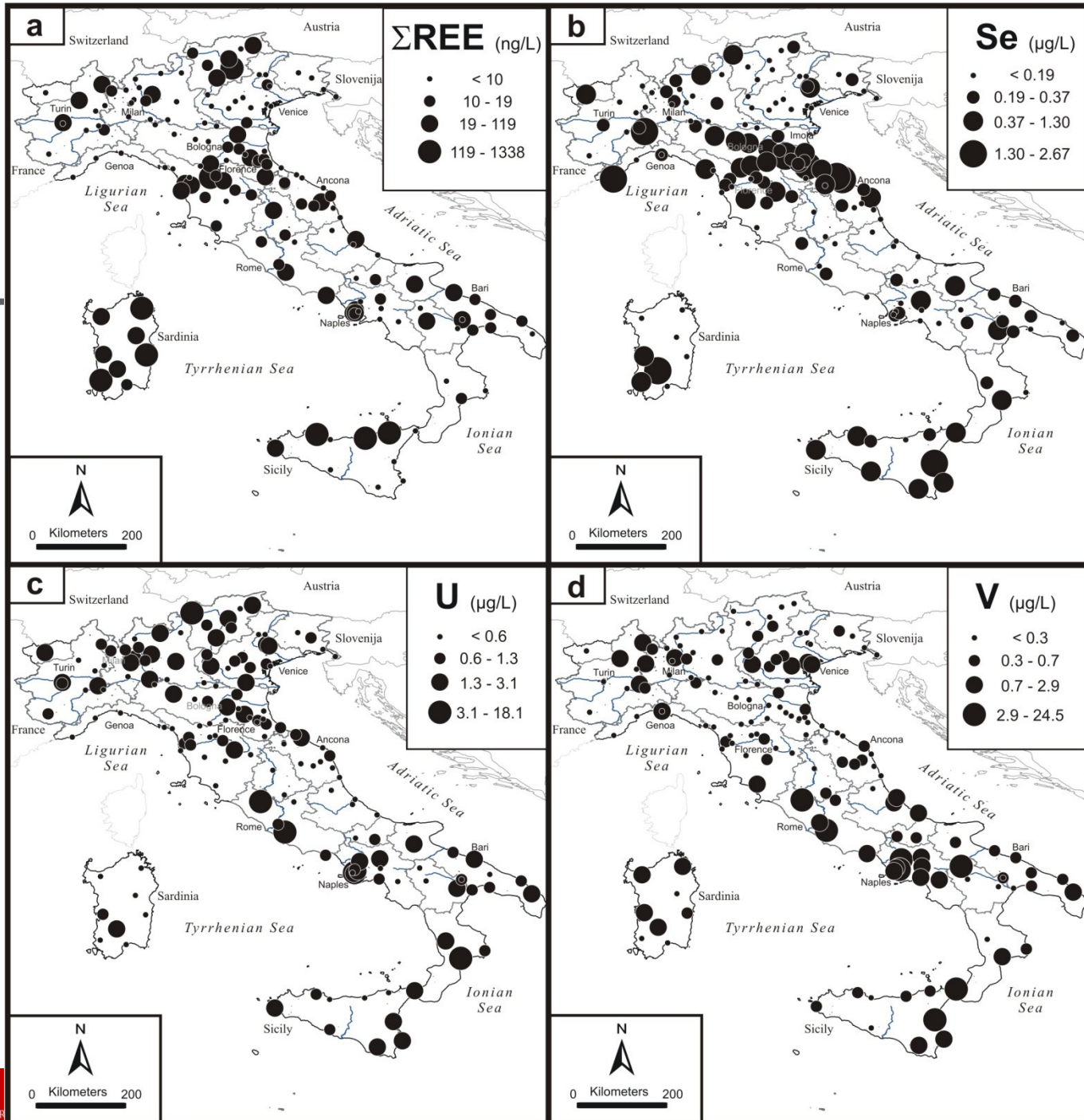






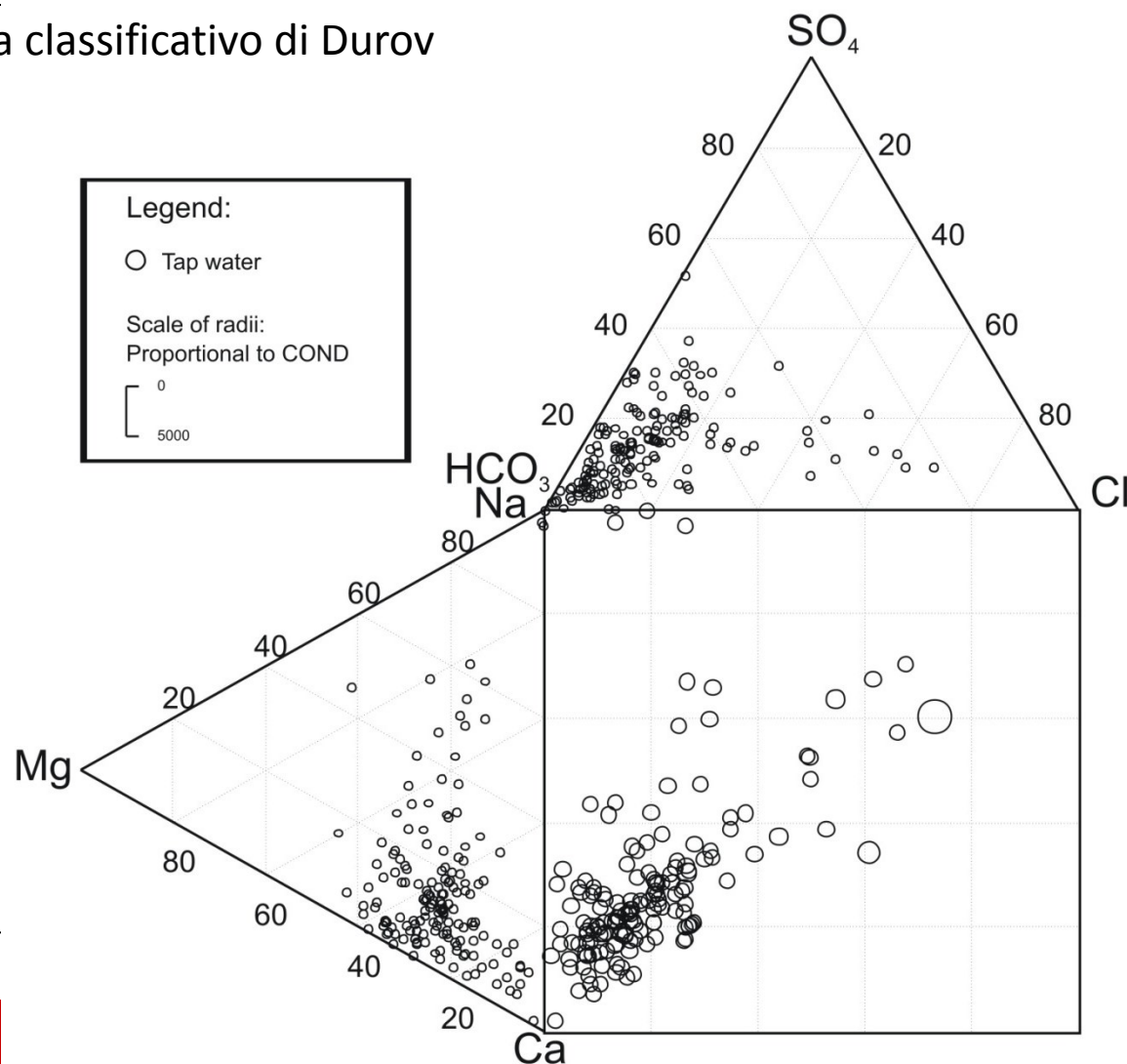


Le acque potabili



Le caratteristiche chimiche delle acque di rubinetto

Diagramma classificativo di Durov



Distribuzione degli elementi principali

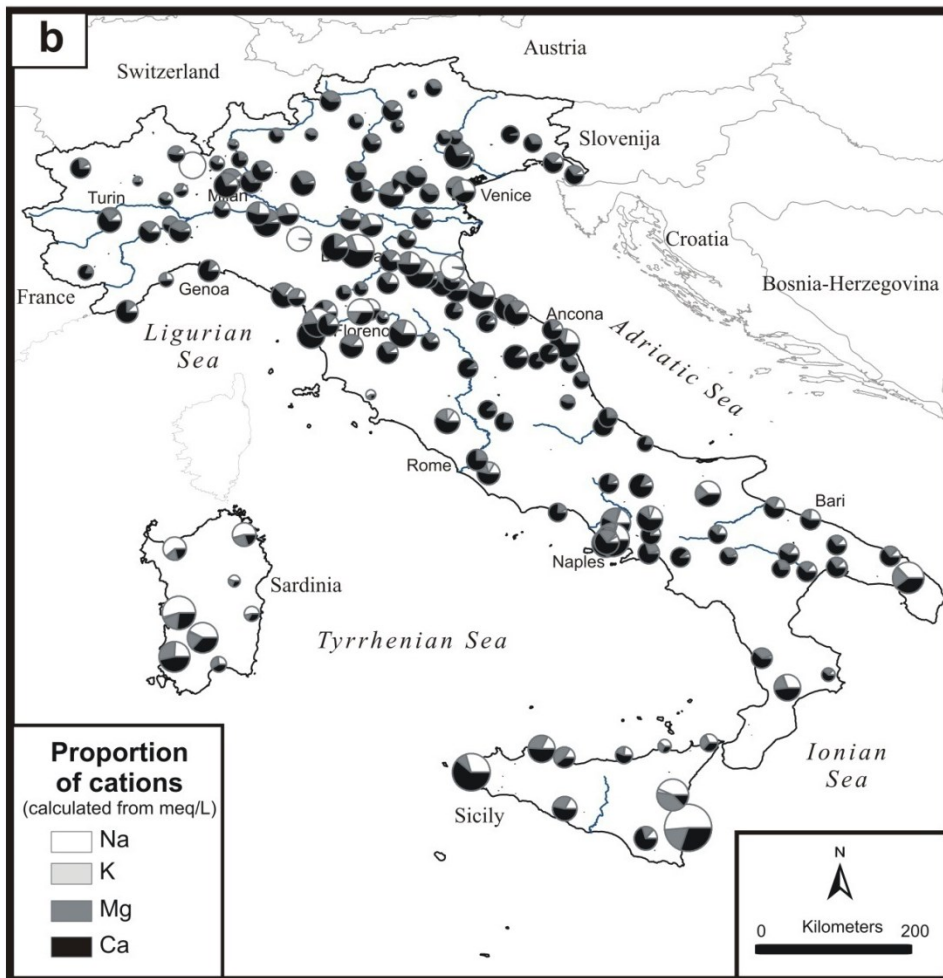
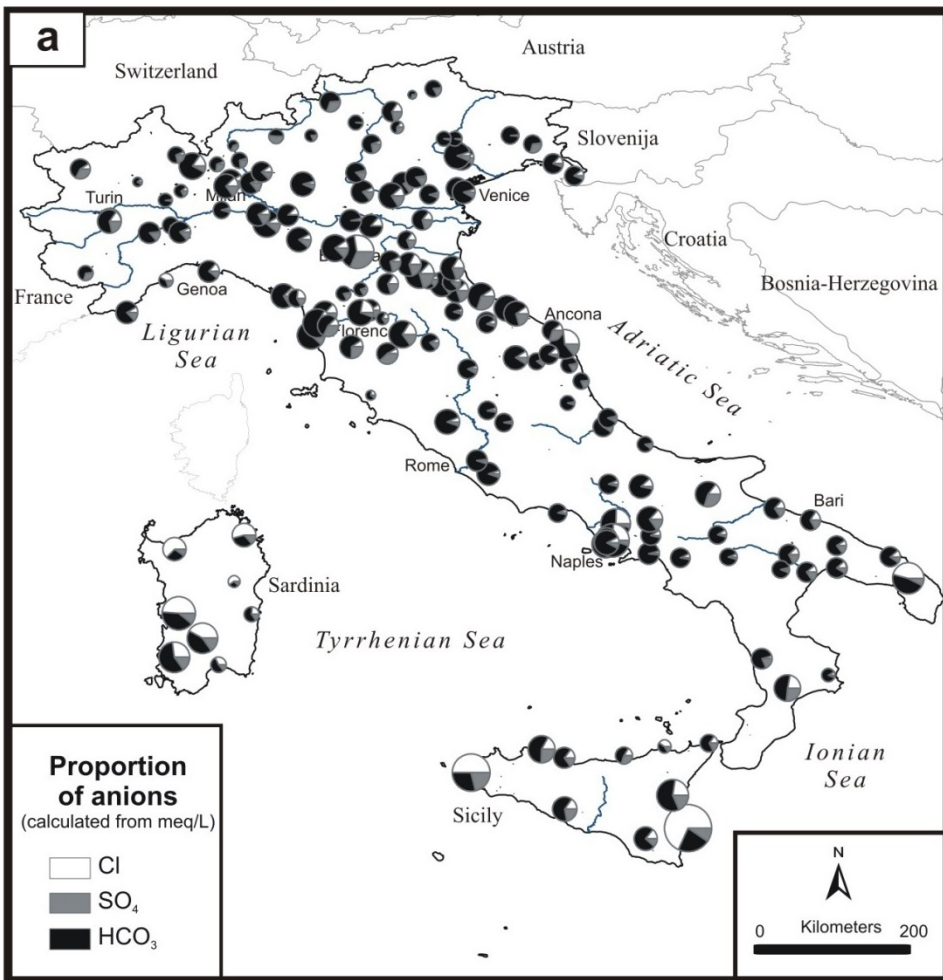
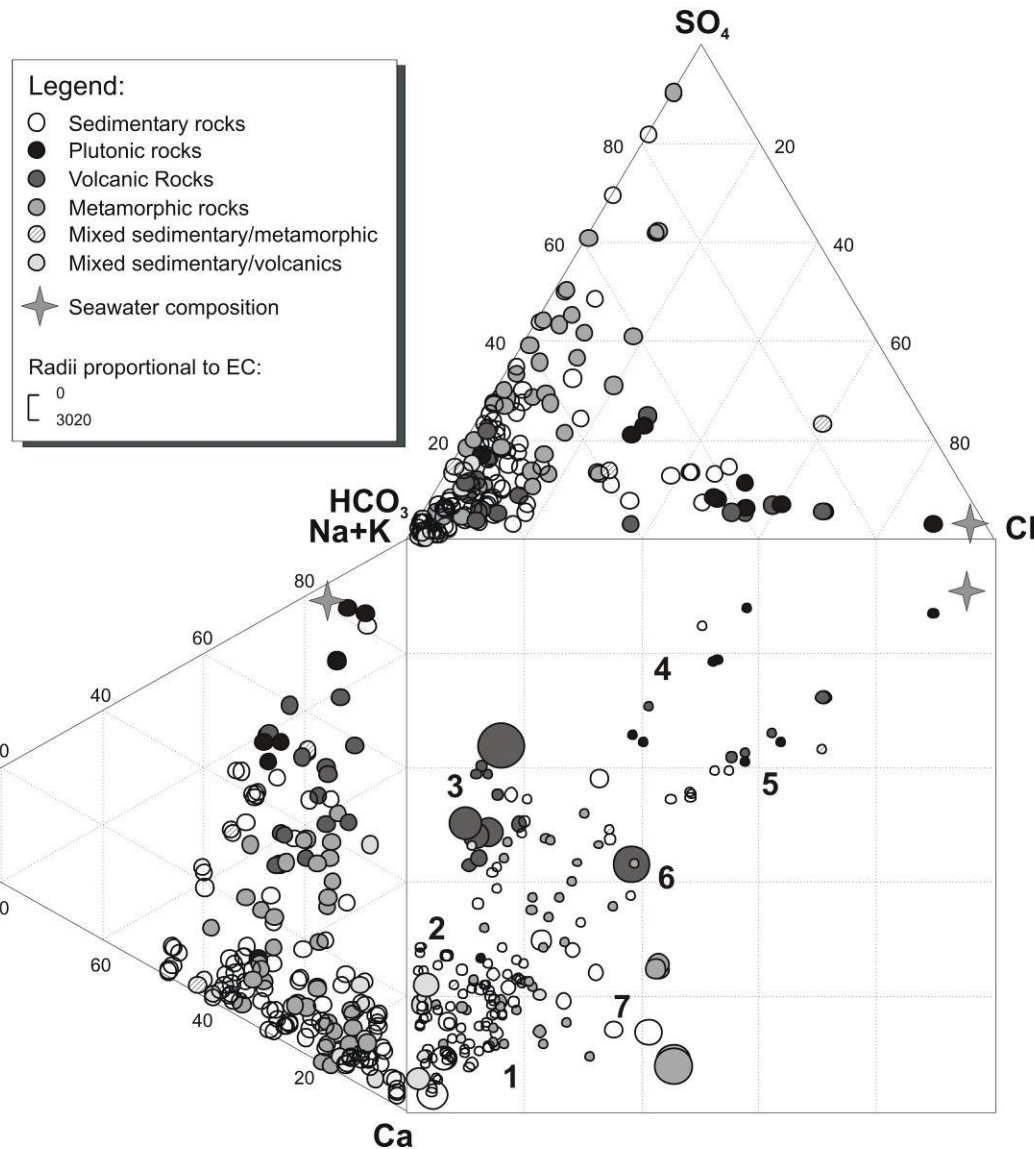


Diagramma classificativo di



1 — Waters with generally low EC, of the Ca-HCO₃ type, deriving from interaction with various lithologies, with a prevalence of sedimentary rocks.

2 — low EC waters, of the Ca-Mg-HCO₃ type. This group includes basically waters interacting with sedimentary rocks, and in particular from areas where dolomitic rocks are abundant.

3 — intermediate to high EC, Ca-Na-Mg-HCO₃ waters, occasionally with high K and often naturally sparkling. It includes many samples from volcanic areas

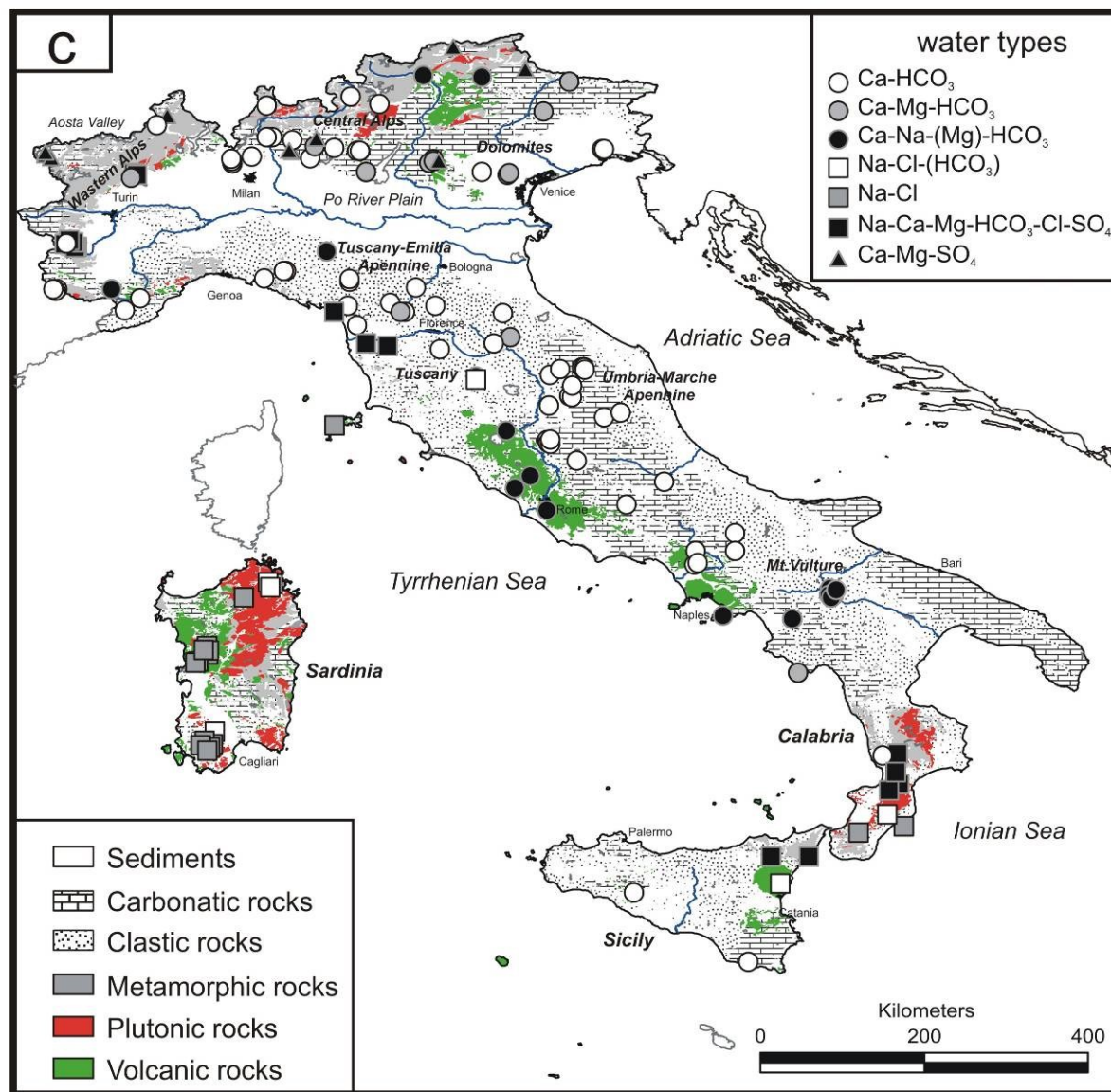
4 — Low EC waters, of the Na-Cl-HCO₃ water type, including many samples from plutonic areas

5 — Low EC, of the Na-Cl, Na-Ca-HCO₃-Cl water type, pointing to a seawater composition, typical of waters from Sardinia and Calabria

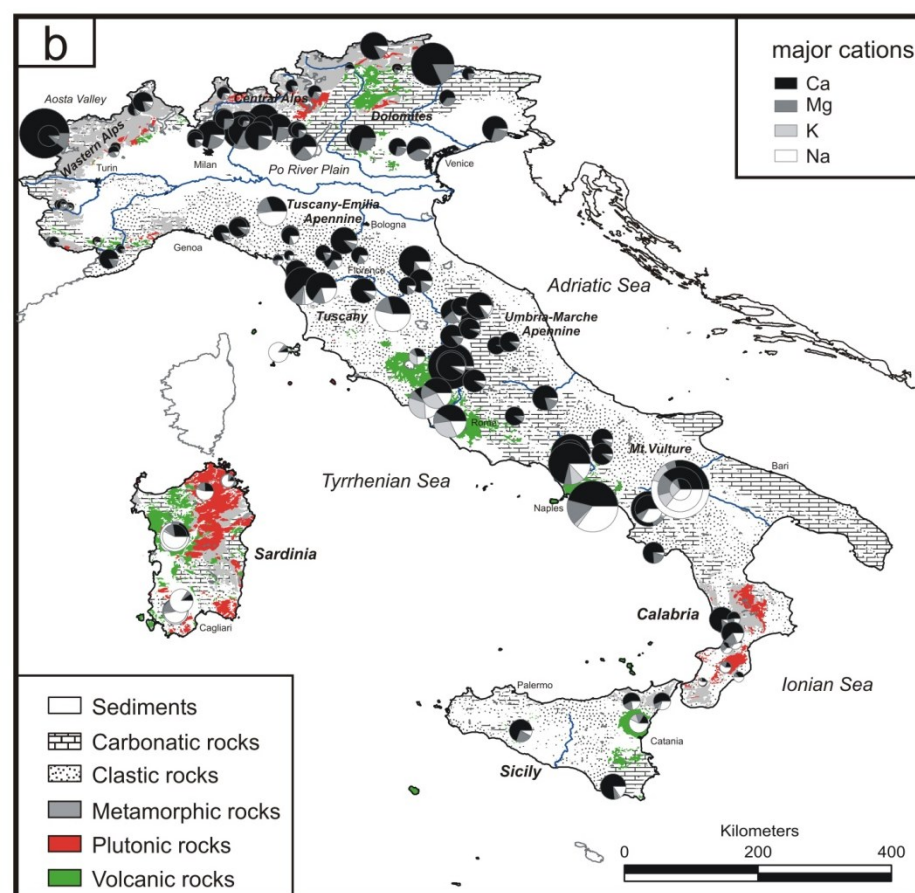
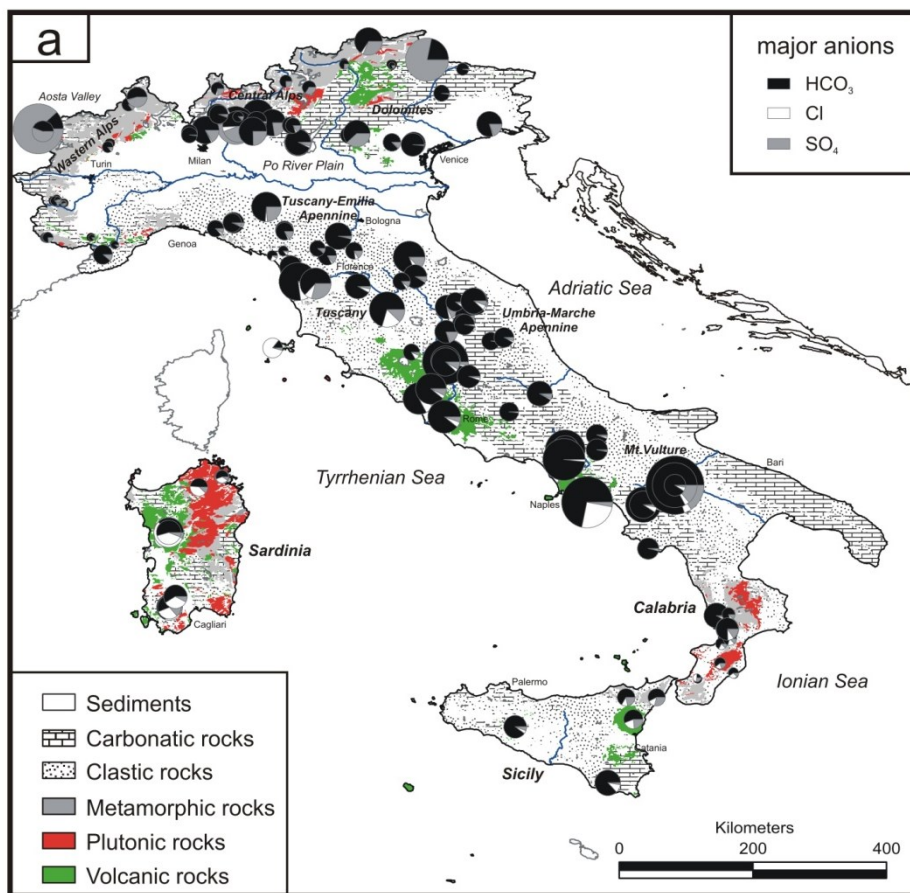
6 — low EC, mixed composition waters (Ca-Na-Mg-HCO₃-Cl-SO₄ type)

7 — high EC, Ca-(Mg)-SO₄ waters, which record interaction with evaporitic rocks and/or sulphide bearing aquifers

Una classificazione complessiva



Le caratteristiche chimiche principali



Le dimensioni dei simboli sono proporzionali al residuo fisso

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Limiti di legge per gli elementi in traccia

Principali contaminanti	Unità di misura	Acque potabili (DPR 236/88) Acque di sorgente (D. lgs. 339/99)	Acque potabili (D. lgs. 31/01)	Acque minerali (Decreto 29 dicembre 2003 del Ministero della Salute)
Antimonio	µg/L	10	5,0	-
Arsenico (As totale)	µg/L	50	10	50
Bario	mg/L	-	-	1
Boro (come B)	mg/L	1*	1,0	5,0
Cadmio	µg/L	5	5,0	3
Cianuro	µg/L	50	50	10
Cromo (Cr ^{III} + Cr ^{VI})	µg/L	50	50	50
Piombo	µg/L	50	10 - 25	10
Mercurio	µg/L	1	1,0	1
Nichel	µg/L	50	20	20
Rame	µg/L	1000	1000	1000
Selenio	µg/L	10	10	10
Nitrati	mg/L NO ₃	50	50	45 (10 per infanzia)
Nitriti	mg/L NO ₂	0,1	0,50	0,02
Vanadio	µg/L	50	50	-
Zinco	µg/L	3000	-	-
Ammonio (come NH ₄)	mg/L	0,5	0,50	-
Alluminio	µg/L	200	200	-
Ferro	µg/L	200	200	-

(attuazione della Direttiva n.2003/40/CE della Commissione nella parte relativa ai criteri di valutazione delle caratteristiche delle acque minerali naturali)



Effetti sulla salute dei diversi tipi di acque

Carattere chimico	Caratteristiche mediche
Carbonatiche e bicarbonatiche	Stimola la secrezione di succhi gastrici, neutralizza l'iperacidità e può avere effetti diuretici
Carbonato o bicarbonato sodiche	Neutralizza acidità, aumenta il metabolismo, favorisce eliminazione di acido urico e depositi di acido urico
Carbonato o bicarbonato potassiche	Diuretiche, antiacide, e effetto anticalcoli, favorisce l'eliminazione di acido urico e depositi di acido urico
Carbonato o bicarbonato magnesiche	Effetto debolmente lassativo, antiacido, favorisce l'eliminazione di acido urico e depositi di acido urico
Carbonato o bicarbonato calciche	Limita e riduce le secrezioni degli apparati respiratori, digestivi e urinari
Bicarbonato ferrose	Aumenta emoglobina nel sangue, favorisce aumento di temperatura, battito cardiaco e peso corporeo, stimola l'appetito
Clorurate/saline	Favorisce l'espulsione di urina e acido urico
Solfuree/saline	Diuretiche e leggermente purganti, stimolano l'escrezione di bile
Clorurato sodiche	Bagni salini per migliorare la reattività della pelle, aumenta la produzione di succhi gastrici e migliora l'appetito
Clorurato calciche	Effetto diuretico e favorisce escrezione di bile
Clorurate calcio magnesiche	Lassative o purganti in funzione della diluizione
Solfato calciche	Effetto positivo sui reni, e effetto diuretico
Bromuro/ioduro sodiche	Stimola l'attività del sistema linfatico e favorisce l'eliminazione di metalli dal sistema
Arsenicali	Aumenta l'appetito e la digestione, stimola le secrezioni delle mucose gastro-intestinali
Anidride carbonica libera	Aumenta la produzione di saliva e di fluidi intestinali, favorisce le funzioni digestive, ha effetto diuretico e antiacido