ECOMEDPORT
Feasibility study of an ecosystem-oriented plant for sediments management in Mediterranean ports and marinas

Port activity in Tunisia: Economy and Environment

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Ports in Tunisia

The history of ports in Tunisia date since the time of Phoenician. The Phoenician port of Carthage was built between 200 and 146 B-J

The merchants who entered their ships, the arsenals remained invisible: they were indeed surrounded by a double wall and doors that allowed merchants to pass the first port in the city without having to cross the arsenals

Fishing ports: 41

These ports can be classified, according to their importance, in two categories:

-The big ports, numbering 12, to shelter the trawlers, the tuna boats, the sardine boats and the coastal fishing units. These ports are in Tazarka, Bizerte, Goulette, Kélibia, Sousse, Monastir, Mahdia, Sfax, Gabes and Zarzis and are equipped with all the services necessary for the fishing activity.

-Small coastal fishing ports, numbering twenty nine (29)

Marine transport Ports: 7

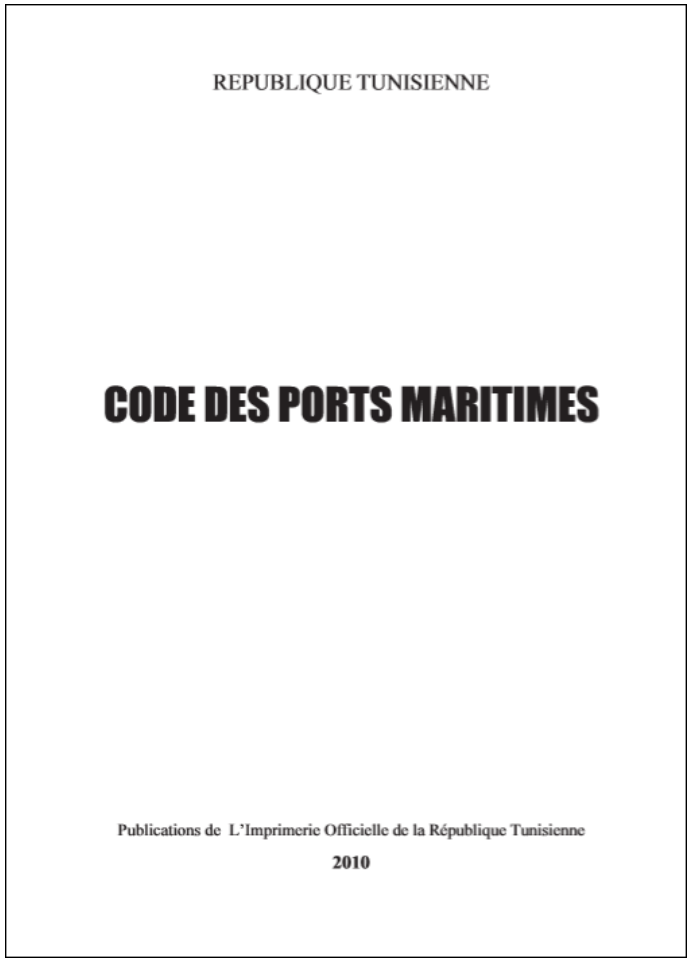
The Tunisian Port Authority which manages the seven Tunisian ports (1,300 kilometers to the Mediterranean Sea): La Goulette, Rades, Bizerte, Sousse, Sfax, Gabes, Zarzis.

Port Radès

Marinas: 8

Tunisia has eight marinas on its shoreline totaling a theoretical capacity of nearly 3266 places. Marina Bizerte, marina yasmine Hammamet, Marina Gammart, Marina Sidi Bou said, Marina port el Kantaoui, Marina Monastir, And Marina Houmet Essouk

Institutional and regulatory aspects of ports



Port activities Code of sea ports:
(law n° 2009-48 du 8 july 2009)

This text contains numerous provisions relating to the protection of the aquatic and coastal environment and resources, as well as to the handling of dangerous goods within the confines of ports. In the case of offenses committed within the maritime ports of commerce, the competent administrative authority has standing to deal with the offenders on the basis of the amounts fixed by a scale of transactions published by Government Decree no. 2016-99 of January 11, 2016

- Improve the competitiveness of the port and ensure the best conditions to reduce the cost and time and improve the quality of services related to ships, people and the marine environment.

- Integration of the protection of the marine environment. Non-renewal of the permit in the case of offenses that have caused serious harm to the environment.

- In Tunisia, there is no legislation covering the management of sediments for beach, but there is a public establishment "Agency for protection and development of Littoral (APAL)" created by the law N° 95-72 24/07/1995 responsible for the management of sedimentary transit.

Environmental impacts of ports

While efficient ports are vital to the economic development of their surrounding areas, the related ship traffic, the handling of the goods in the ports and the hinterland distribution can cause a number of negative environmental impacts.

Shipping has an environmental impact both in ports, as well as in the immediate vicinity of the ports.

Examples of these impacts are noise from ship engines and machinery used for loading and unloading, exhausts of particles, CO_2, NO_x and SO_2 from the ship's main and auxiliary engines, and dust from the handling of substances such as grain, sand and coal.

Road and rail traffic to and from the port area cause additional environmental problems.

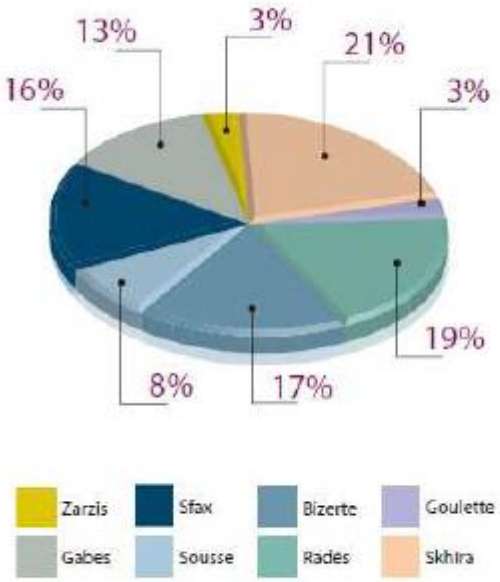
problems caused at sea by ships calling at the port

Hydrocarbons are an important source of pollution, especially in the event of an accident during transport by sea or by leak or accident on an oil platform

Table 1: Type of Incidents with Probable Volume Spilled at Ports

Type of incident	Estimated value (Tonne)
Operational pollution related to improper handling	<2
Accident during the loading / unloading of petroleum products on oil tankers.	<10
Accident during welding operations.	2 – 20
Accidents liés aux opérations de chargement / déchargement des produits pétroliers au terminal pétrolier.	<100
Collision entre navires avec rupture d'une cuve de fuel de soute (porte container, vraquier, autre).	500 à 700
Collision between ships with rupture of a tank of petroleum products on a tanker.	7 500
Sinking of a medium-sized tanker with loss of any its cargo of hydrocarbons	80000 -100000

Distribution of Trafficking by Port
Average percentage



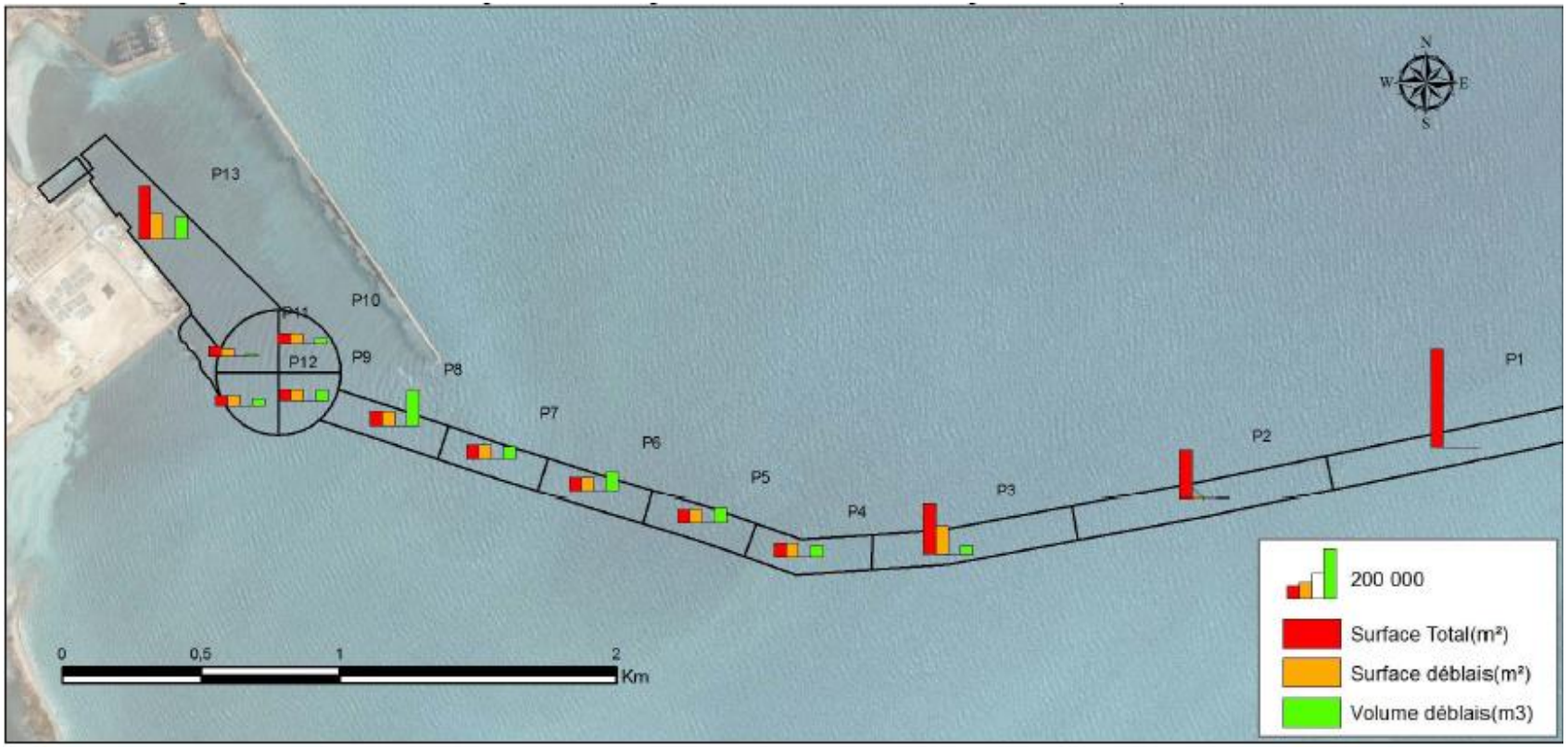
problems caused by port activity itself

Sedimentation is one of the most important problems that affect most of tunisian ports.

Case of the port of Zarzis

General situation of the commercial port of Zarzis

Total area, surface to be dredged and dredged volumes in the basins, the circle of evade and the channel of the commercial port of Zarzis



The materials dredged in ports and their access channels are two types :

Sediments rich in fine sediments have high levels of organic matter and sulphides and are often anoxic.

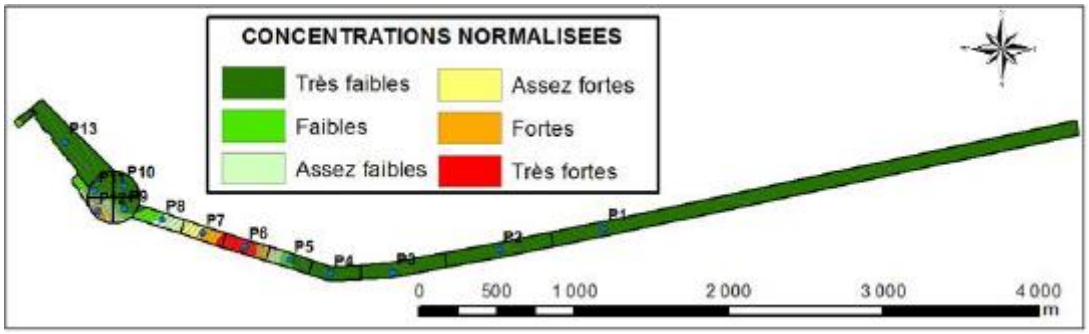
These conditions favor the effective immobilization of many contaminants, as long as the dredged material is not subject to the action of waves and currents likely to resuspend it;

Coarse sediments, which are generally low in organic matter, have a low immobilization capacity of metals and organic contaminants: these materials are generally not contaminated.

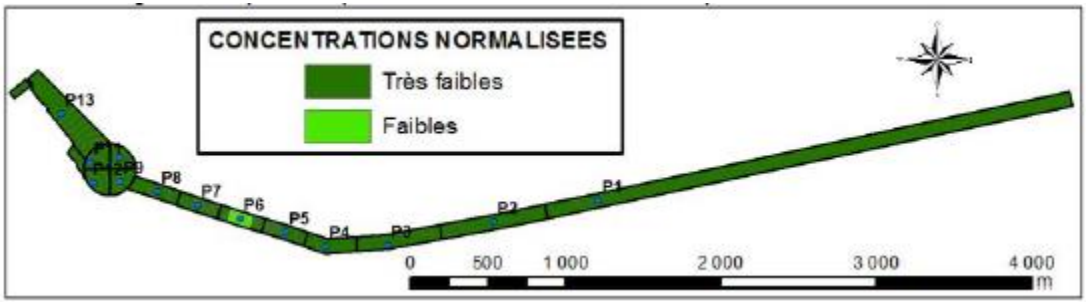
In the case of contaminated sediments, potentially toxic substances may be released at the time of mixing with the body of water. As a result, the contaminated coarse sediments have a significant potential for release of the contaminants they contain, regardless of the deposit method chosen (at sea or on land).

Sediment quality is very important to determine reject at sea or on land).

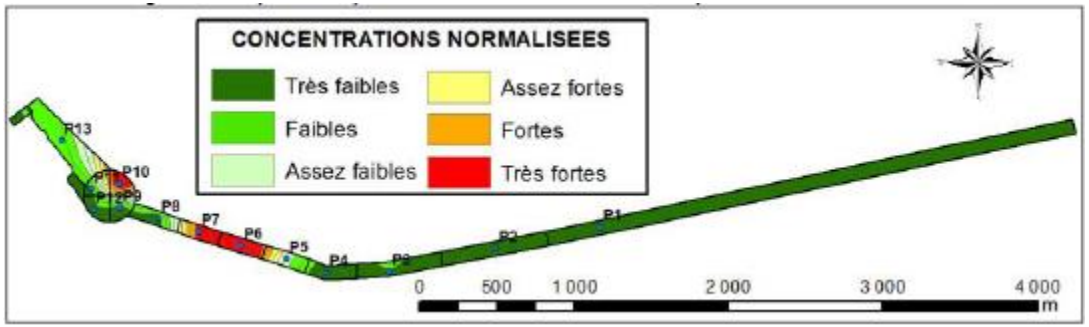
Distribution of detectable concentrations obtained for heavy metals, namely chromium, copper, nickel, zinc and mercury. He was impossible to trace these isoconcentrations for cadmium and lead whose concentrations in the 13 measured samples remained undetectable. All concentrations shown in different shades of green are below the threshold of acceptability, while the others are above.



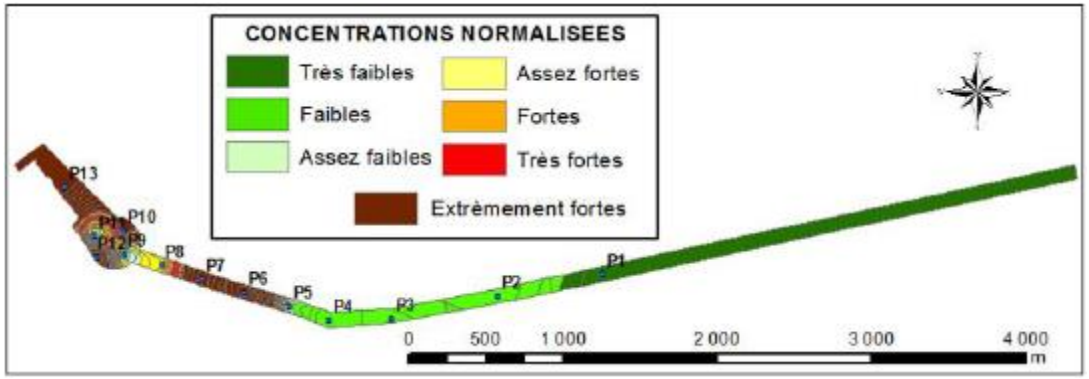
Cr



Hg


CONCENTRATIONS NORMALISEES
Très faibles
Faibles
Assez faibles
Assez fortes
Fortes
Très fortes
P13
P10
P9
P8
P7
P6
P5
P4
P3
P2
P1
0
500
1 000
2 000
3 000
4 000
m

Cu


CONCENTRATIONS NORMALISEES
Très faibles
Faibles
Assez faibles
Assez fortes
Fortes
Très fortes
Extrèmement fortes
P13
P10
P9
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P2
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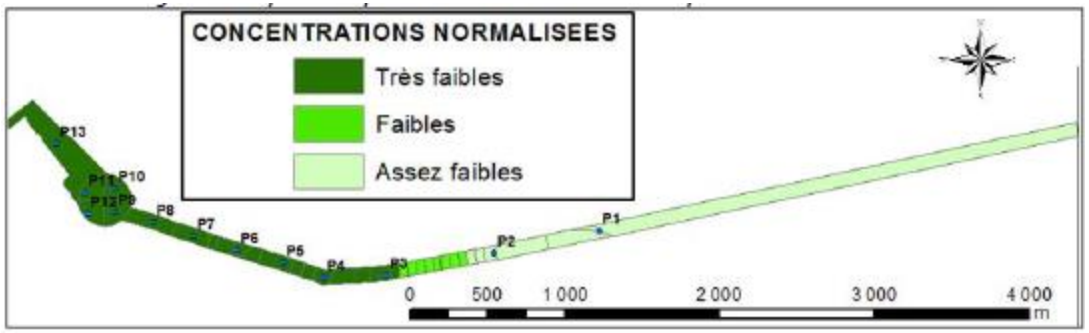
Ni


CONCENTRATIONS NORMALISEES
Très faibles
Faibles
Assez faibles
P13
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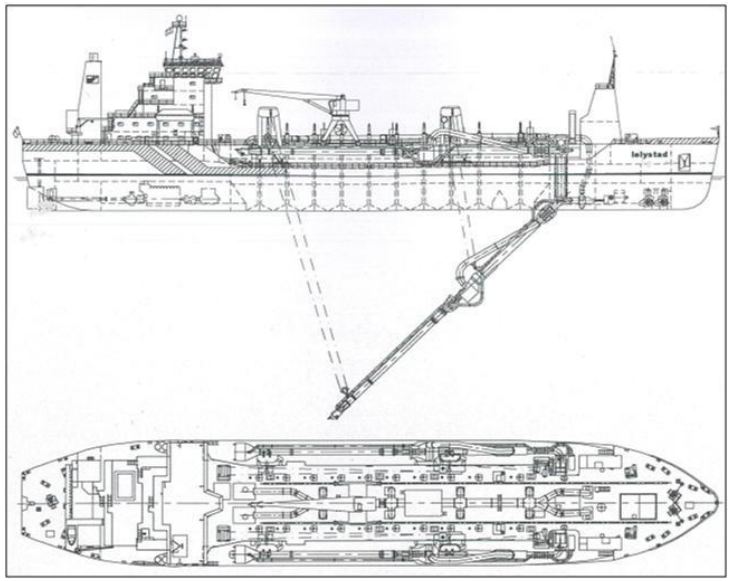
4 000
m

Zn

Recommendation of the use of a self-supporting hydraulic dredge

In order to minimize the impacts of dredging, it is the use of a drag self-supporting hydraulic and tug equipped with a pulled grader blade that is recommended.



The suction dredge in motion can carry in its well the sediments it has sucked up with water by one or two hoses touching the bottom, called dragging elves At the bottom of each head of elinde, a beak is attached. The suction is done using centrifugal pumps mounted on the slings or inside the ship in the pump room. (} The depression created by pumps produces a sufficient suction effect to disintegrate and could transport the mixture of sediment and water through the spout and suction hoses down to the well of the dredge. Once this well filled, the drag transports and evacuates the materials to the zone of clapping.

Problems related to port hinterland

In port of Manzel Bourguiba Bizerte, Sfax or Gabes the industrial activity near port can be harmful with presence of rejects that can be accumulated in the port by currents or during transportation.

Manzel Bourguiba port sediment

Paramètres chimiques (mg/Kg)	Valeurs mesurées				
Pb	69	59	66	220	117
Hg	0,452	0,611	0,385	0,495	0,825
Zn	18,15	16	24	141	45
Cu	11	10	29	367	74
Cd	25	0,4	0,4	0,4	0,4
Ni	28	25	30	34	27
Cr	42	40	85	63	42
Sn	<1,25	<1,25	<1,25	<1,25	<1,25
COT %	1,02	1,2	1,83	1,8	1,82
Hydrocarbures totaux	900	300	1000	300	1100
Sulfures %	ND	0,45	ND	ND	ND

Pb — Accumulation

Cd — Local Accumulation

Gabès Port sediment

Zn Accumulation

Cd Accumulation

Paramètres chimiques (mg/Kg)	Valeurs mesurées													
Pb	16	8	6	21	29	21	14	19	17	17	4	8	3	0,5
Hg	0,245	0,061	0,193	0,213	0,166	0,207	0,174	0,215	0,097	0,327	0,18	0,064	0,145	0,158
Zn	461	425	537	629	1464	1045	1559	1597	1225	1688	130	40	85	6
Cu	39,5	33	37,5	49	11	57	77	95	73	54	36	29	15	18,6
Cd	51	54	66	85	176	132	219	207	201	223	36	53	7	4,6
Ni	25	37	35	41	78	69	79	282	86	60	7	25	6	1
Cr	247	113	24,5	191	247	243	201	25	243	180	12	54	0,5	1,7
Sn	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25
COT %	1,15	3,01	3,86	4,45	7,45	7,5	10,88	13,5	9,78	2,77	3,22	5,93	2,57	2,94
Hydrocarbures totaux	8238	19 098	4945	9466	3542	3844	4056	5083	5638	931	117	676	272	329
Sulfures %	0,53	2,61	1,78	2,56	2,35	2,5	4,95	3,9	3,14	1,62	0,25	1,83	0,23	0,49

Sfax Port sediment

Cd Local Accumulation

Paramètres chimiques (mg/Kg)	Valeurs mesurées															
Pb	49	32	30	19	14	22	24	14	5,7	27	12,6	12	16	8,7	3,4	6,5
Hg	0,517	0,105	0,267	0,189	0,149	0,136	0,22	0,191	0,174	0,203	0,114	0,096	0,125	0,12	0,174	0,161
Zn	440	269	237	174	101	262	42	99	65	80,4	61	51	71	58	25	19
Cu	95	44	50	28	13	23	11	21	4	9,5	8,4	7,6	9	7,4	3,5	4,4
Cd	14	9,5	18	9	4,5	6,5	0,6	3	1,2	2,4	2,2	1	1,4	2,25	0,6	<0,05
Ni	19,5	15	23	15	14	18	5	19	1,3	5	16	16	18	10	5	9
Cr	65	51	70	50	35	71	10	34	3,2	11	19	36	50	14,4	12	10,5
Sn	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25	<1,25
COT %	3,5	2	1,65	1,85	2,8	3,57	1,4	1,04	0,27	3,44	2,88	5,47	3,96	5,7	2,66	3,59
Hydrocarbures totaux	2400	1300	1400	200	8200	800	500	400	600	1300	700	700	300	300	300	979
Sulfures %	1,22	0,73	0,74	0,53	1,7	1,08	0,26	ND	ND	ND	0,69	0,65	0,53	0,69	ND	ND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THANK YOU!