Workshop on protection of groundwater as a source of drinking water in karst area
Malinska, Island Krk (Croatia) 14-15 April 2008

Hydrogeological characteristics of some karst transboundary aquifers of Albania and their environmental problems

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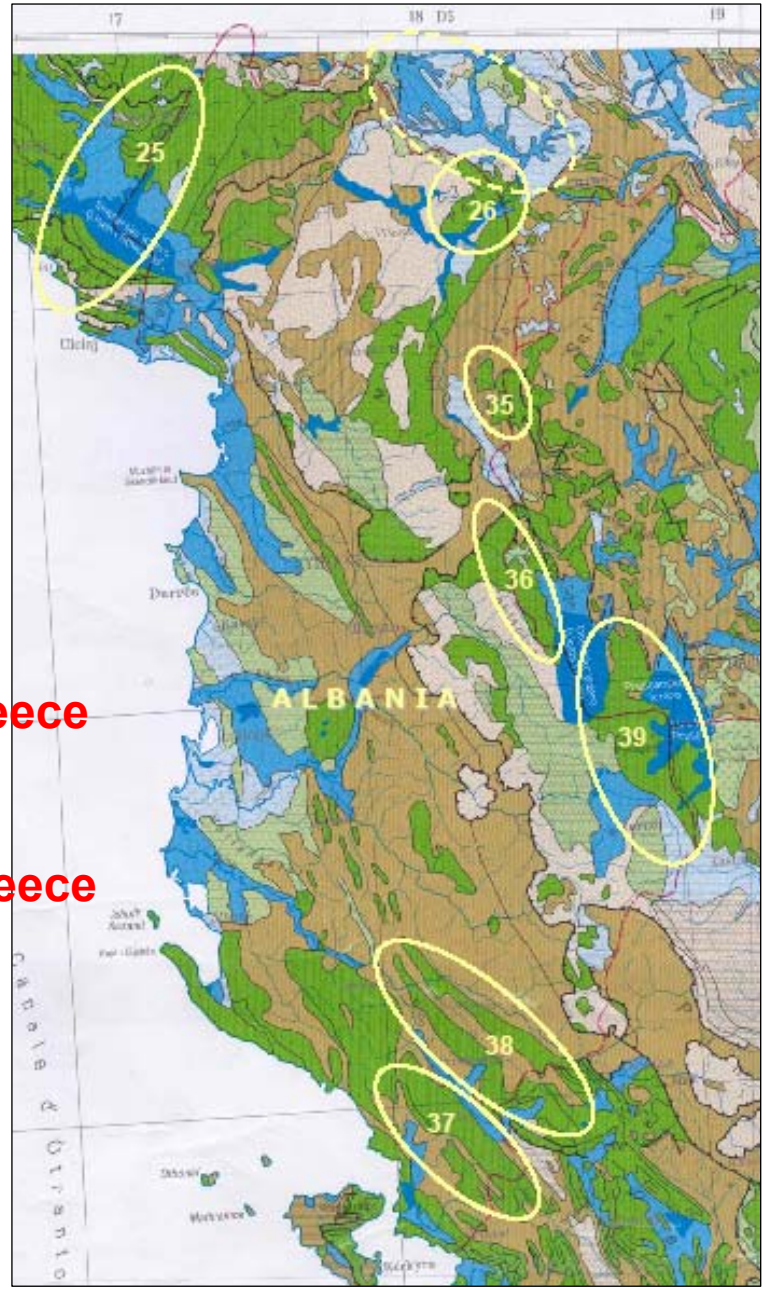
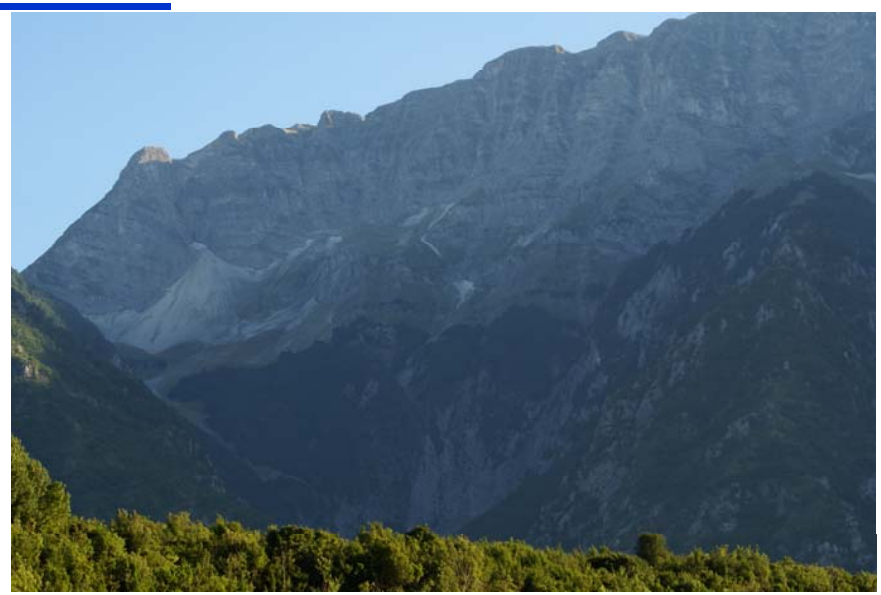
Transboundary aquifers of Albania

25. Shkodra Lake; Albania – Montenegro
26. Beli Drim / Drini Bardhe; Albania – Kosovo
35. Korab / Bistrica Stogovo; Albania - FYROM
36. Jablanica / Golobordo; Albania - FYROM
37. Mali Gjere / Mourgana Mountain; Albania - Greece
38. Nemechka / Vjosa-Pogoni; Albania - Greece
39. Prespa and Ohrid Lakes; Albania, FYROM, Greece



Physical environment of the aquifers

- The transboundary aquifers are mostly of limestone and dolomite karts type and less of alluvial porous
- The total surface of transboundary aquifers within the Albanian territory is about 2000 km^2; their total surface is equal to about 1/3 of the total surface of karst aquifers of Albania.
- The transboundary aquifers related to mountains with highest peaks more than 2000 m a.s.l.
- The recharge zones of the karst aquifers are at high mountains areas, usually at elevations more than 1000 m a.s.l.



Groundwater resources of transboundary aquifers

- Total groundwater resources of transboundary aquifers in Albanian territory are:

about 65-70 m^3/s
or about 25 % of the country's karst water resources

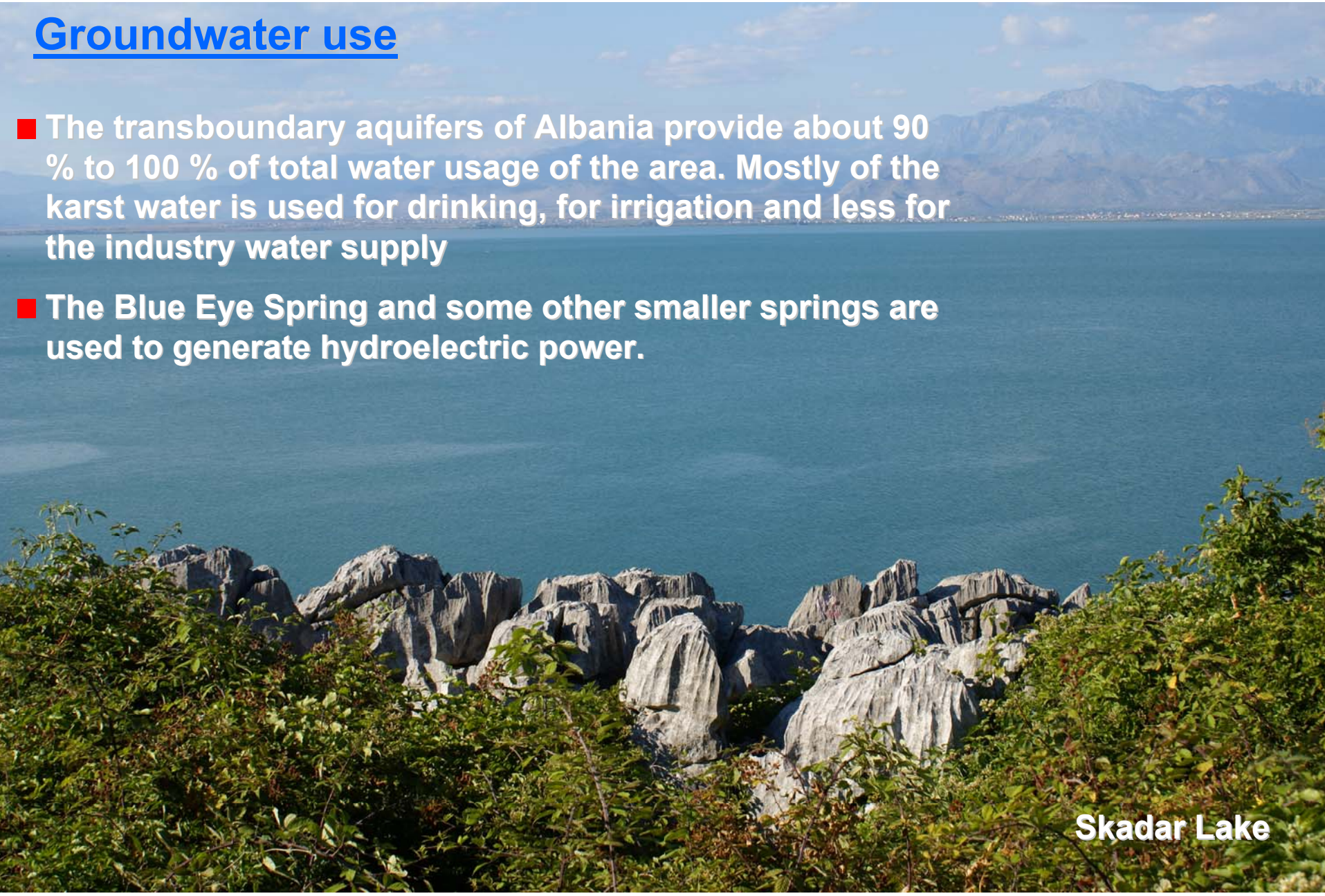
- The bigest kasrt spring of transboundary aquifers

1. Syri Sheganit, about 1 to 10 m^3/s
2. Borova Spring, about 0,8 m^3/s
3. Tushemisht Spring, 2.5-3.5 m^3/s
4. Saint Naum Spring, 7.5 m^3/s
5. Kelcyra Springs, about 6-7 m^3/s
6. Blue Eye Spring, about 18.4 m^3/s
7. Viroi Spring, 0 - >40 m^3/s
8. Lista Spring, 1.5 m^3/s
9. Gramou Spring, 0.5 m^3/s, Rogozi etc.

Blue Eye Spring

Groundwater use

- The transboundary aquifers of Albania provide about 90 % to 100 % of total water usage of the area. Mostly of the karst water is used for drinking, for irrigation and less for the industry water supply
- The Blue Eye Spring and some other smaller springs are used to generate hydroelectric power.



Groundwater quality problems

- Main reasons of the karst water pollution:

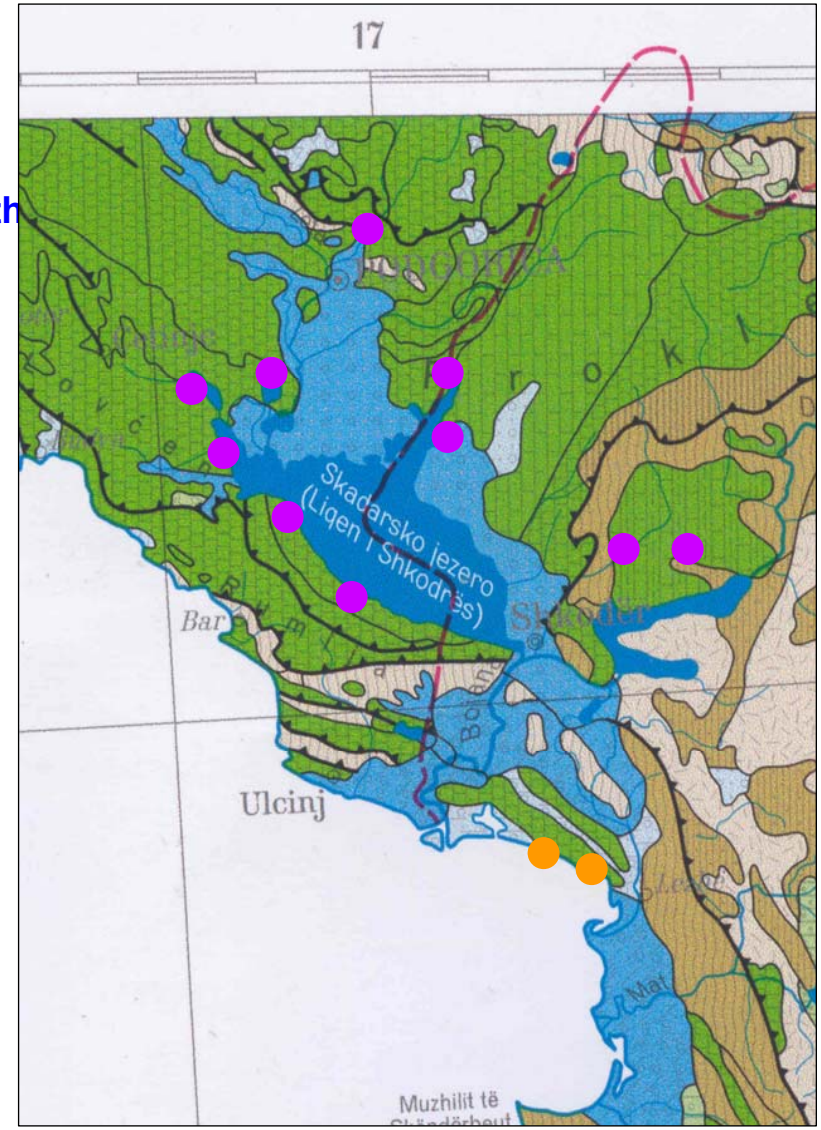
a) Lack of landfills
b) Lack of waste water treatment plant
c) lack of industrial water treatment plant
d) Presence of dangerous hot spots from the abandoned industrial plants
e) Insufficient public awareness
f) Insufficient responsibility and preparation of the administrative water bodies

- Infiltrated surface water may induce pollutants into the karst aquifer:

Mali Gjere / Mourgana karst massif

Shkodra Lake Transboundary aquifer

- Shkodra lake is the biggest of Balkan Peninsula.
- In this area is situated Shkodra, the biggest city of North Albania and Podgorica the biggest city of Montenegro.
- The karst aquifer drains intensively in the Adriatic sea (as brackish water springs) and in Shkodra Lake (as fresh water springs).
- The sustainable development of the area is closely related to the anthropogenic implications in hydrologic equilibrium of the lake and to the use and protection of karst water.
- The sources of pollution are;
  a – Waste water of Shkodra and Podgorica
  b – Pesticide deposits in Bajza, Albania
  c – Aluminum plant in Podgorica
- Main environmental problem of the future is the construction of Bushat EPP, which may cause:
  a – Lowering of Shkodra Lake level
  b – Despairing of about 5000 ha of wetlands in Montenegro



Transboundary aquifer of Prespa and Ohrid Lakes

Prespa Lake:

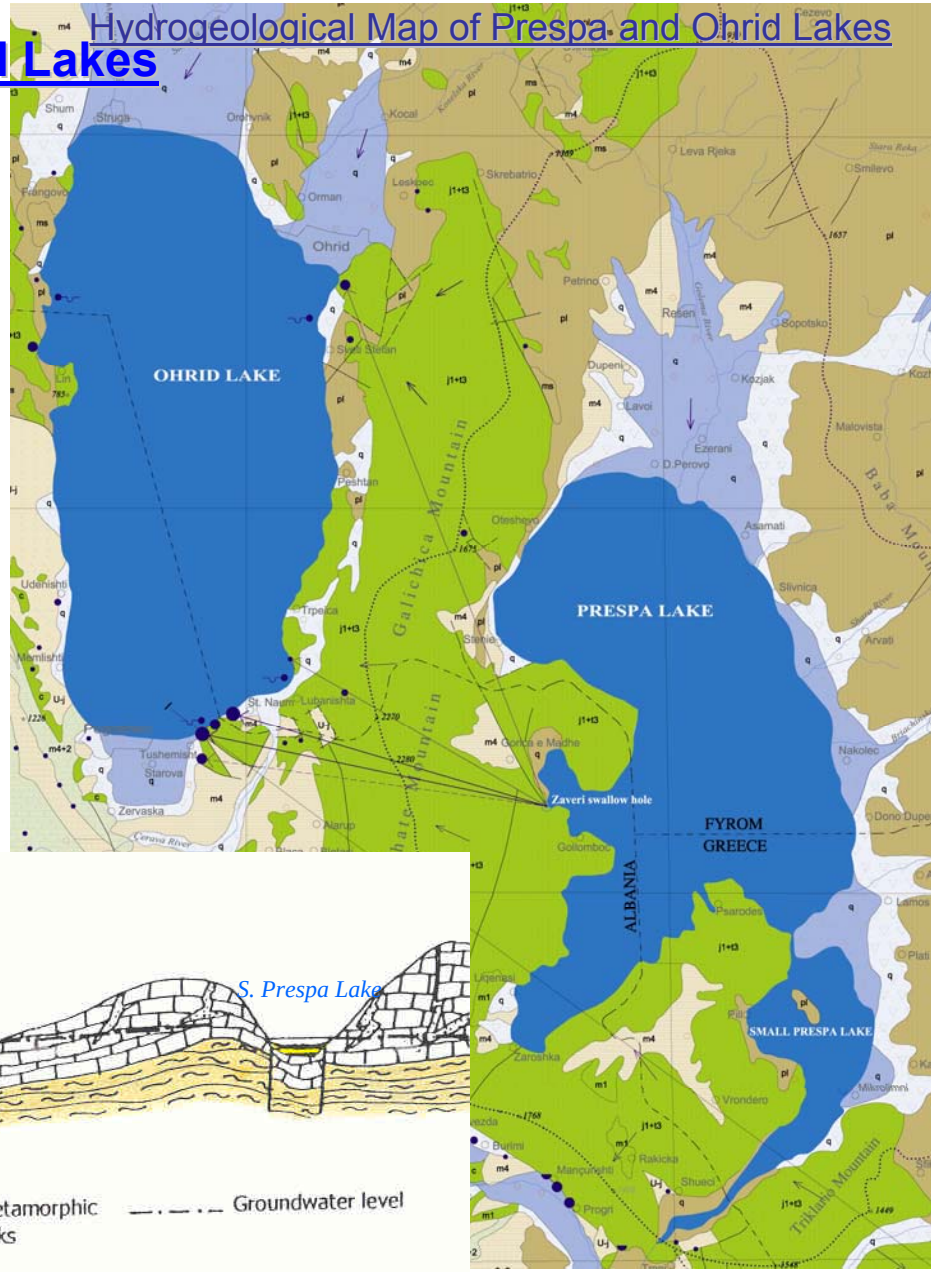
elevation	850 m a.m.s.l.
maximal depth	280 m
lake surface	274 km2

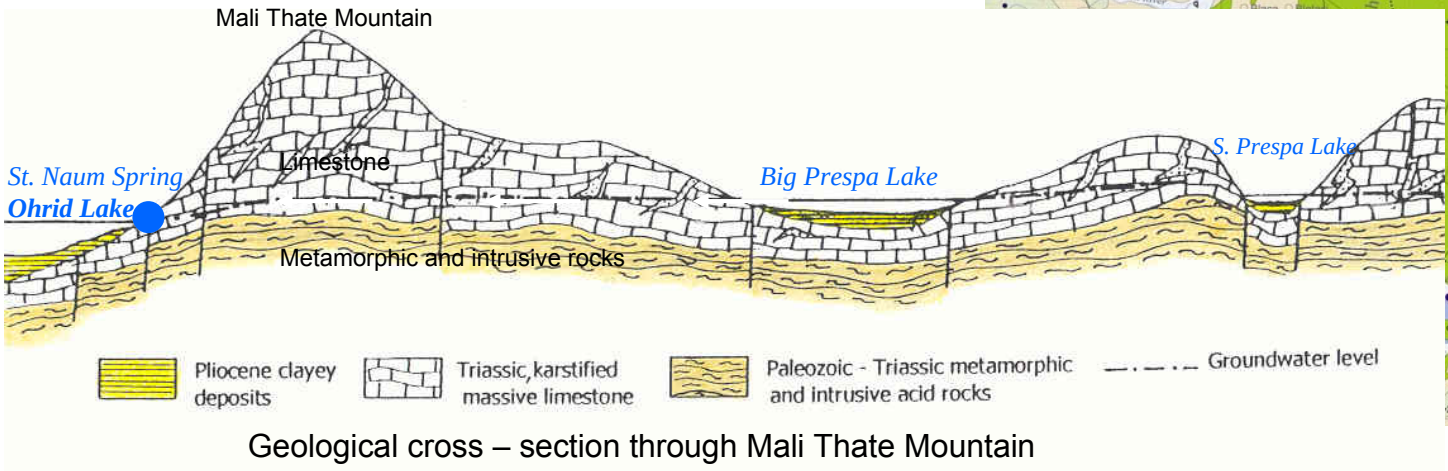
Ohrid Lake

elevation	695 m a.m.s.l.
maximal depth	30 m
lake surface	348 km2

Prespa Lake recharges Ohrid Lake through Mali Thate-Galichica karst massif

Hydrogeological Map of Prespa and Ohrid Lakes



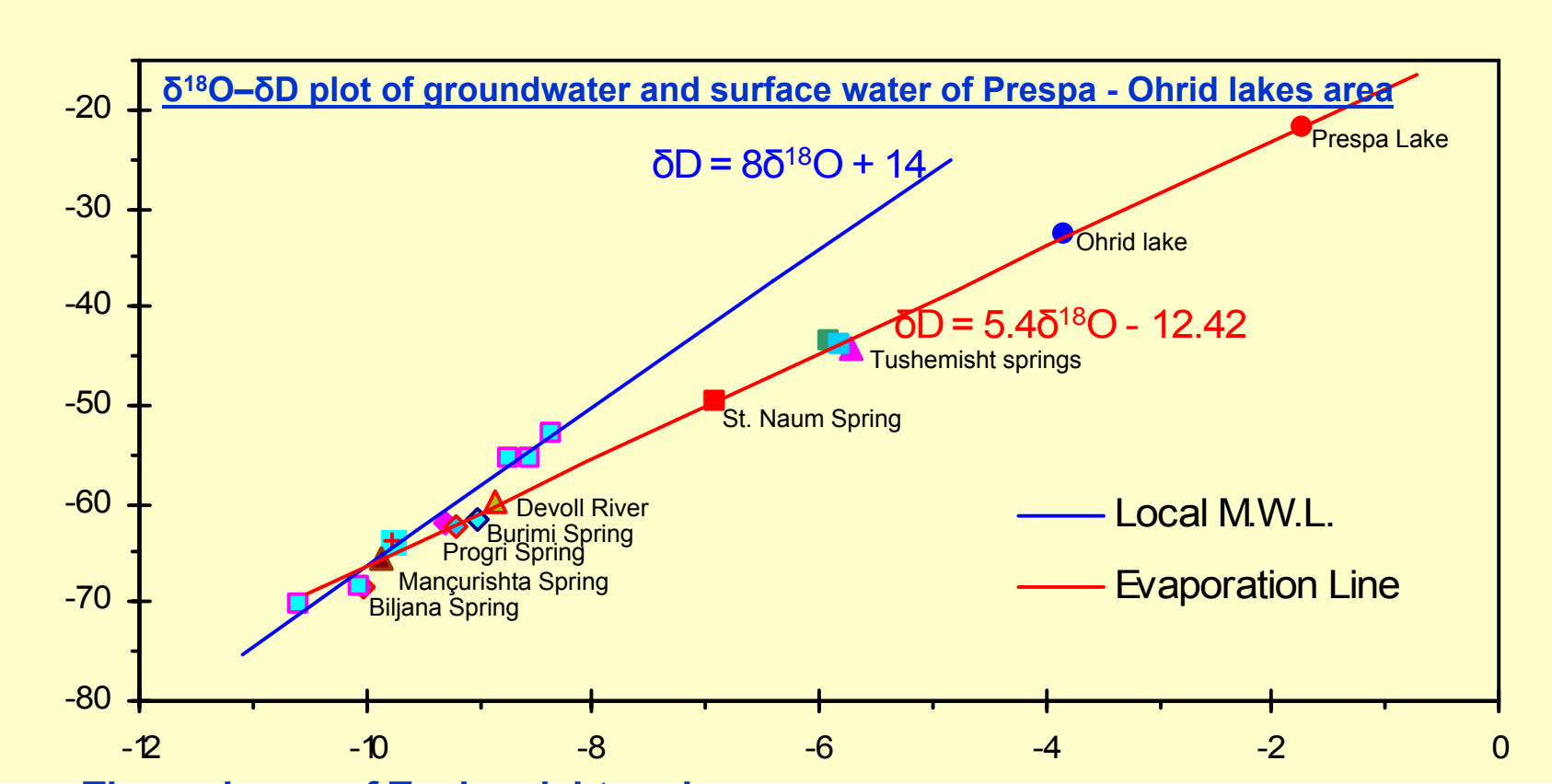


Geological cross – section through Mali Thate Mountain

Biggest springs

- Saint Naum Spring, 7.5 m3/s
- Tushemisht Spring, 2.5-3.5 m3/s
- Biljana Spring, 0 5 m^3/s
- Unknown quantities drained on the lake coastal line
  (it is supposed to be about 1-2 m^3/s)

Investigation of the connection between Prespa and Ohrid Lakes



- **The recharge of Tushemisht spring:**
  53 % by the Prespa Lake
  47 % by the infiltrated in the karst basin precipitations
- **The recharge of St. Naum spring:**
  38 % by the Prespa Lake
  42 % by the infiltrated in the karst basin precipitations
- **With artificial tracers is found; the maximal karst flow velocity 3200 m/h**

Environmental problems

- Prespa lake is in the limit of the eutrophication (Phosphorous 10-60 μg/l)
- The transport of the pollutants from Prspa Lake to Ohrid Lake
- Lake Ohrid as an tendency of increasing phosphor content

  (Construction of waste water treatment plants)
- Silting of the Small Prespa Lake by the sedimentation of the

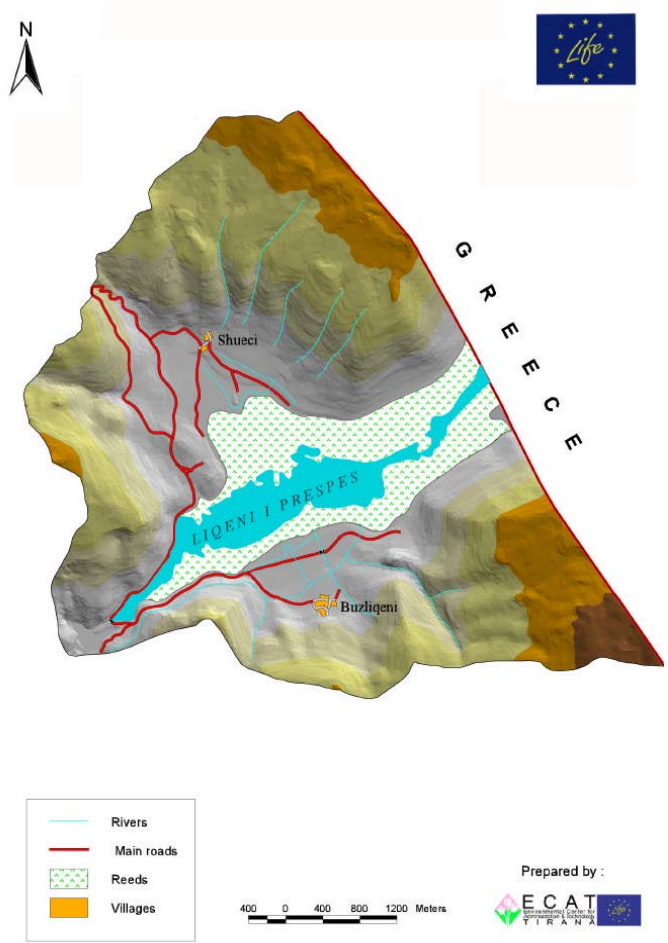

Prespa Lake


Ohrid Lake

Silting of the Small Prespa Lake

1. Devoll River was diverted in Small Prespa Lake in 1978 to increase the lake water volume for irrigation use

2. In 7-8 years has been sediment into the Lake about 1.500.000 m^3 of clay and silt



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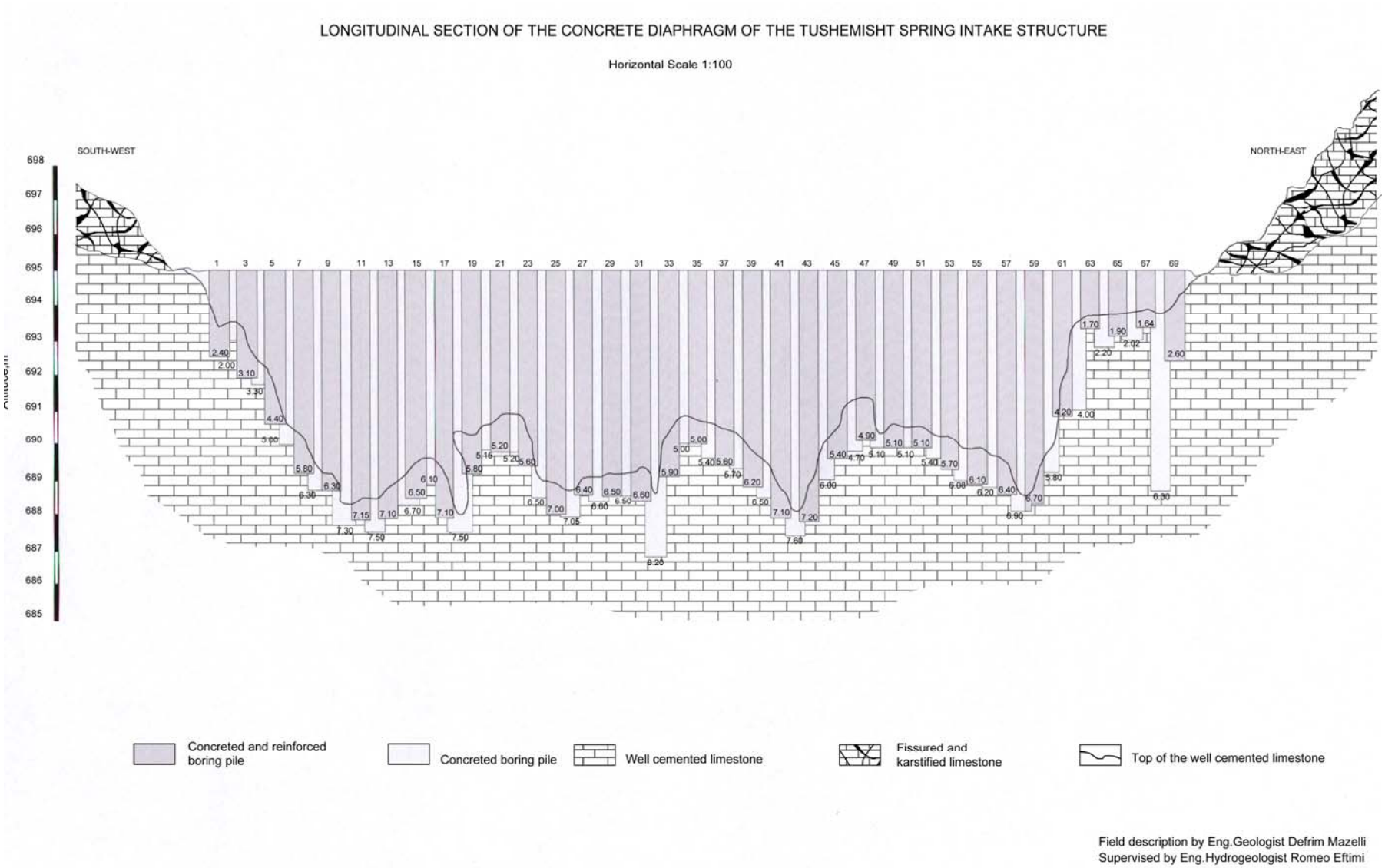
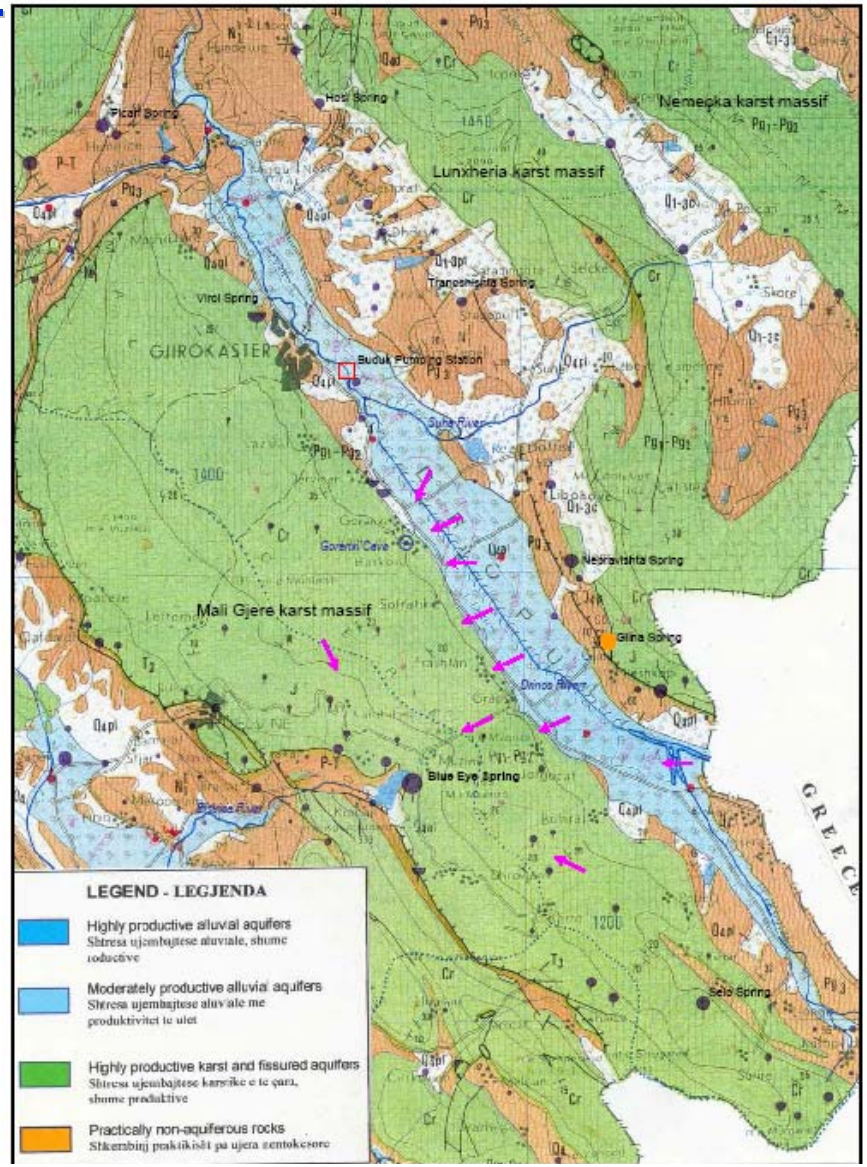
Construction of the new spring intake for the water supply of the town of Pogradec


LONGITUDINAL SECTION OF THE CONCRETE DIAPHRAGM OF THE TUSHEMISHT SPRING INTAKE STRUCTURE
Horizontal Scale 1:100
SOUTH-WEST
NORTH-EAST
Concreted and reinforced boring pile
Concreted boring pile
Well cemented limestone
Fissured and karstified limestone
Top of the well cemented limestone
Field description by Eng.Geologist Defrim Mazelli
Supervised by Eng.Hydrogeologist Romeo Eftimi

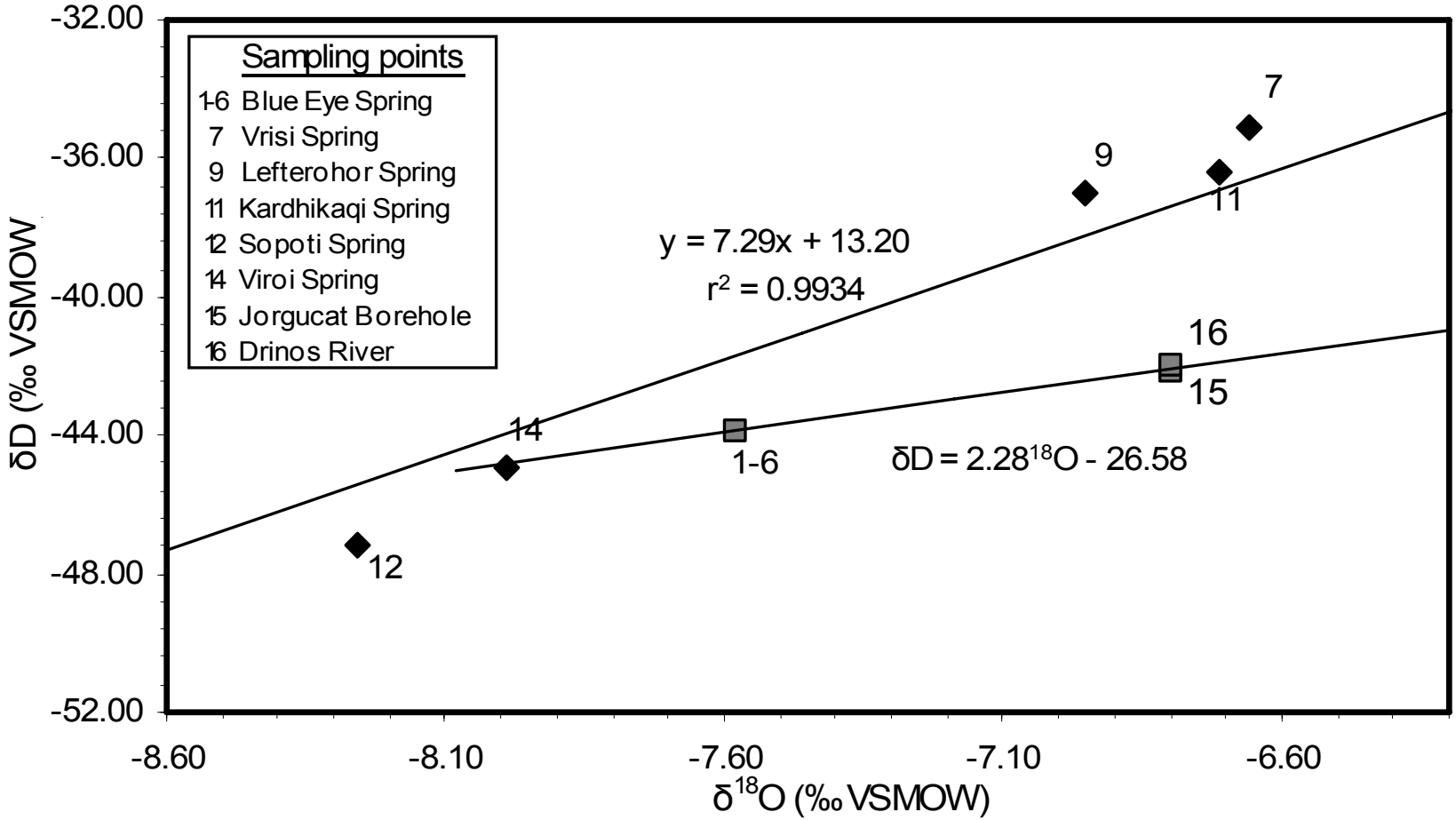
Mali Gjere transboundary aquifer

- Blye Eye spring, mean discharge 18.4 m3/s
- The Blue Eye Spring has relatively high sulfate concentration (about 135 mg/l)
- The Drinos River is recharged by the sulfate springs of Garmou, Rogozi etc.
- The sulfate content of Drinos River alluvial basin vary aroudn 500-600 mg/l

Hydrogeological Map of Mali Gjere karst massif and Drinos River Valley

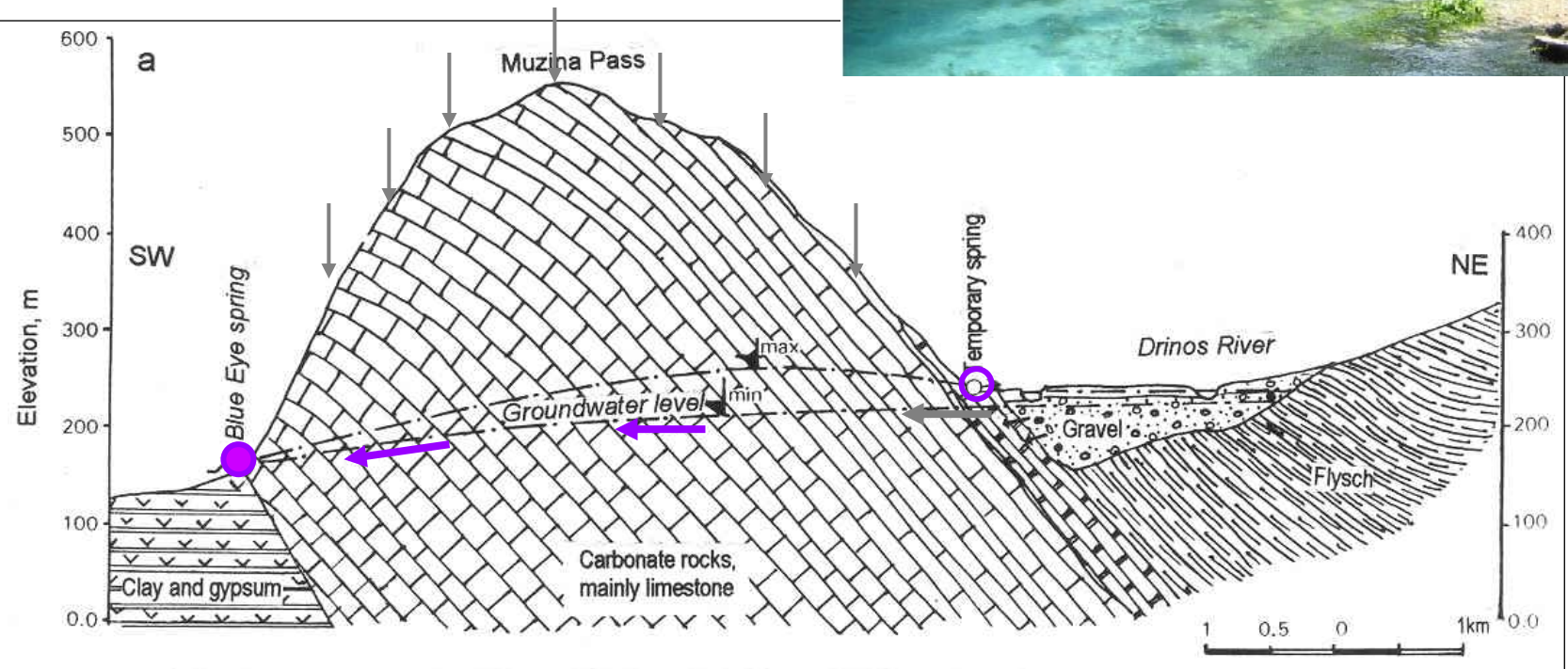


Investigation of the connection between Blue Eye Spring and of alluvial groundwater of Drinos River Basin



Blue Eye Spring

- Avearge discharge = 18.5 m^3/s
- Hydrochemical type: HCO_3–SO_4-Ca
- The recharge sources:
  30-35% from Drinos Alluvial Plain
  65=70% from the karst massive



The following measures should be taken for a successful management of transboundary aquifers:

- **The transboundary aquifers should be integrated into the river basins management plans;**
- **For a successful management of transboundary aquifers should be created specialized bilateral and multilateral joint bodies;**
- **The joint bodies have to elaborate joint programs, for groundwater inventory, groundwater quantity and quality monitoring, and have to propose actions for protection of the groundwater;**
- **To improve the legal aspects of the management of transboundary aquifers**
- **The most important transboundary aquifers of Albania on which special attention should be paid are the following;**

  Shkodra Lake aquifer

  Prespa and Ohrid lake

  Mali Gjere / Mourgana Mountain


Thank You for your attention