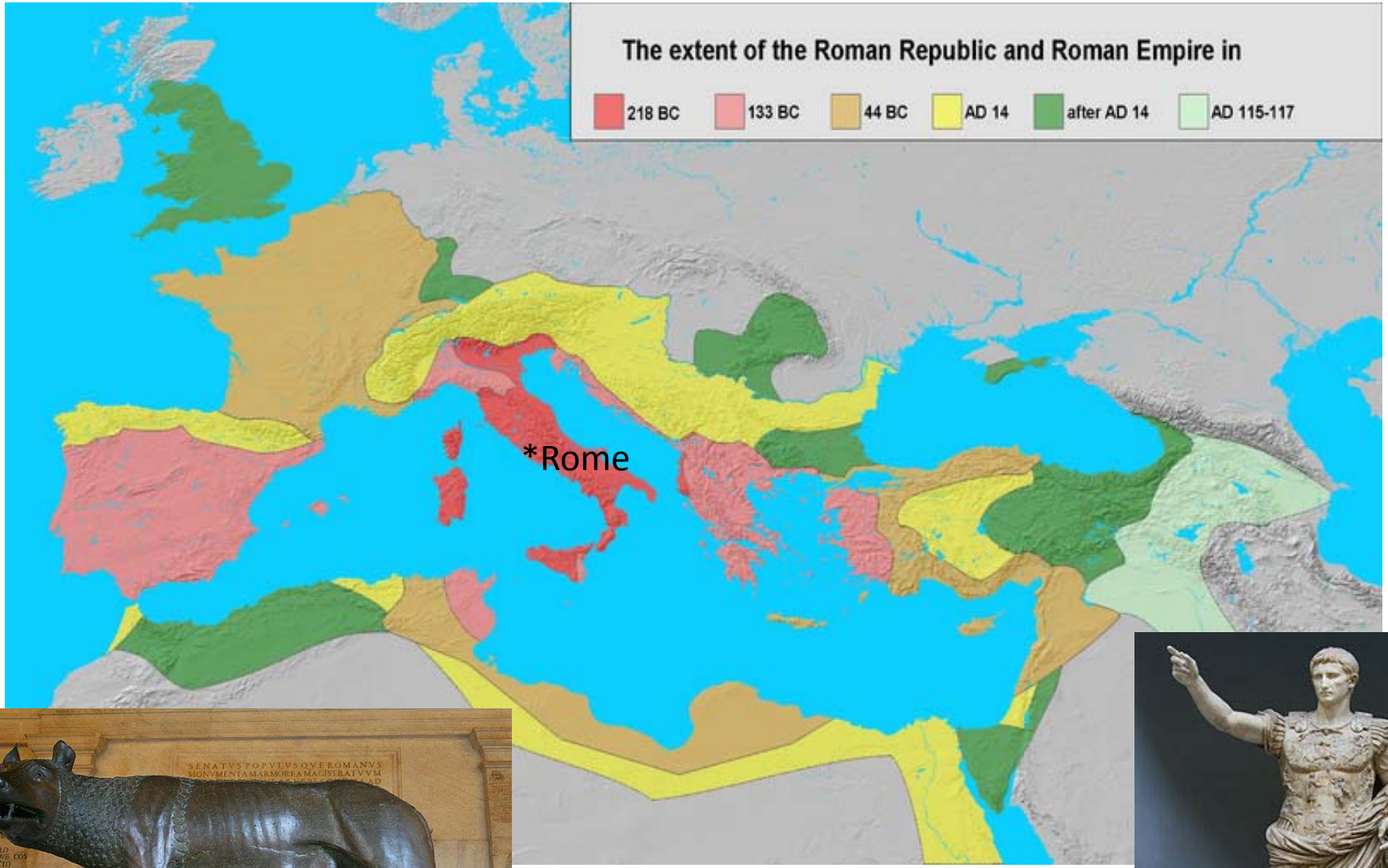
The Roman Aqueduct of Nîmes, France



Romulus and Remus

Augustus

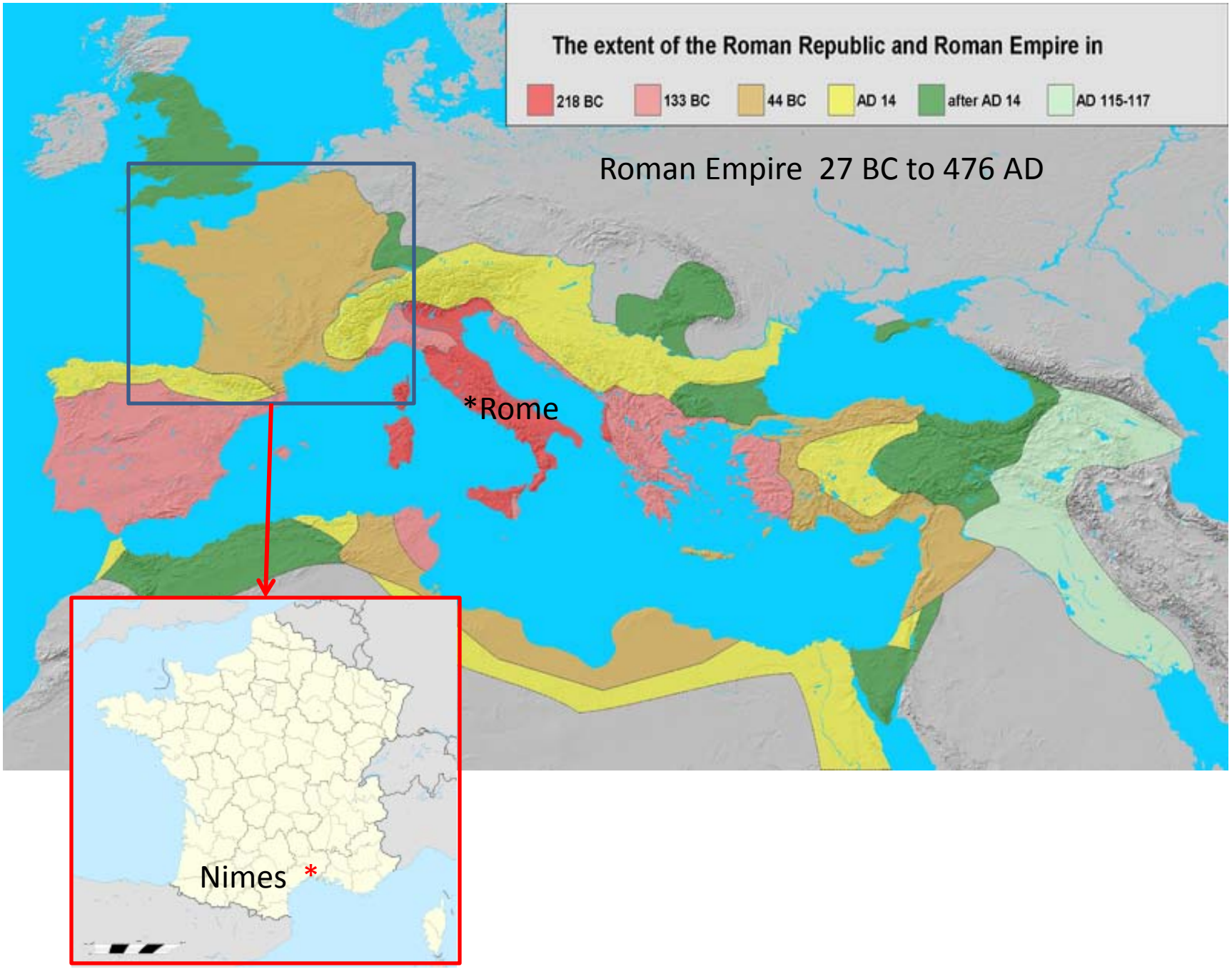
http://en.wikipedia.org

http://en.wikipedia.org

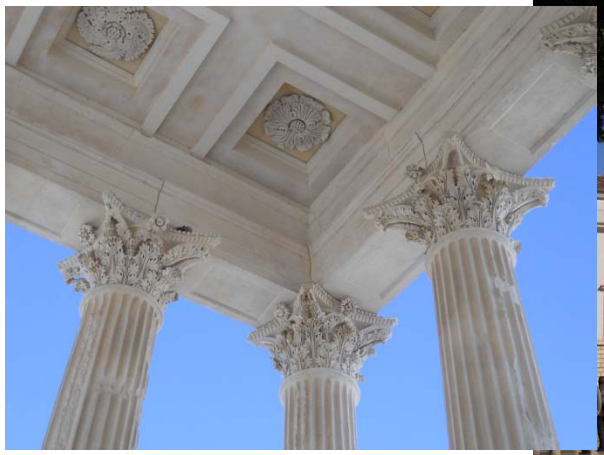
Pantheon

http://en.wikipedia.org

Appian Way


The extent of the Roman Republic and Roman Empire in
218 BC
133 BC
44 BC
AD 14
after AD 14
AD 115-117
Roman Empire 27 BC to 476 AD
*Rome
Nimes *

Nîmes, France



Maison Carrée

Roman Amphitheatre

Jardins de la Fontaine

the original water supply of Nîmes

What is an Aqueduct?

- From two Latin words:
  - *aqua* "water" + *ductus* "a leading, conducting“
- An artificial channel for conducting water from a distance, usually by means of gravity.
- The water channel can be an open or covered trench, in a tunnel, in a pipe, or on a bridge.

Overview of the Nîmes Aqueduct

* Year completed: around 50 AD
* Total length: 50 km (30.5 miles) (70% below ground)
* Average slope: 0.34 m/km (.034% slope)
* Minimum slope: 0.07 m/km (.007% slope) (~4.5”/mile)
* Flow rate: 20,000 to 38,000 m^3/day (500 to 900 gpm) (~1 mgd)
* Transit time from source to Nîmes: 28 to 32 hours
* Average velocity: ~1.5 fps
* Population served: approximately 60,000 people

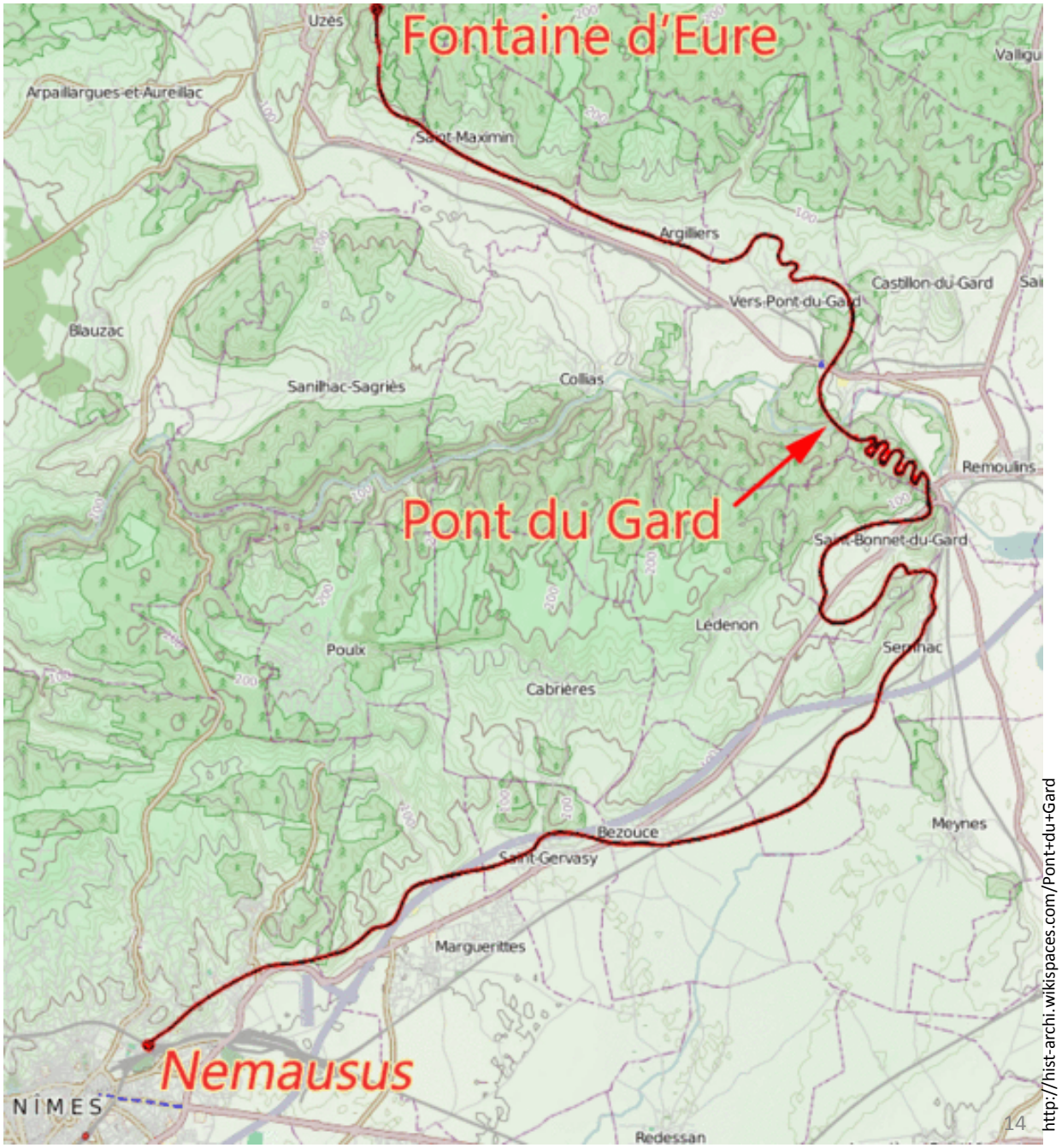
The Water Source

"SOURCE of the EURE
captured by the Romans
for supplying Nimes
drinking water
through the aqueduct"

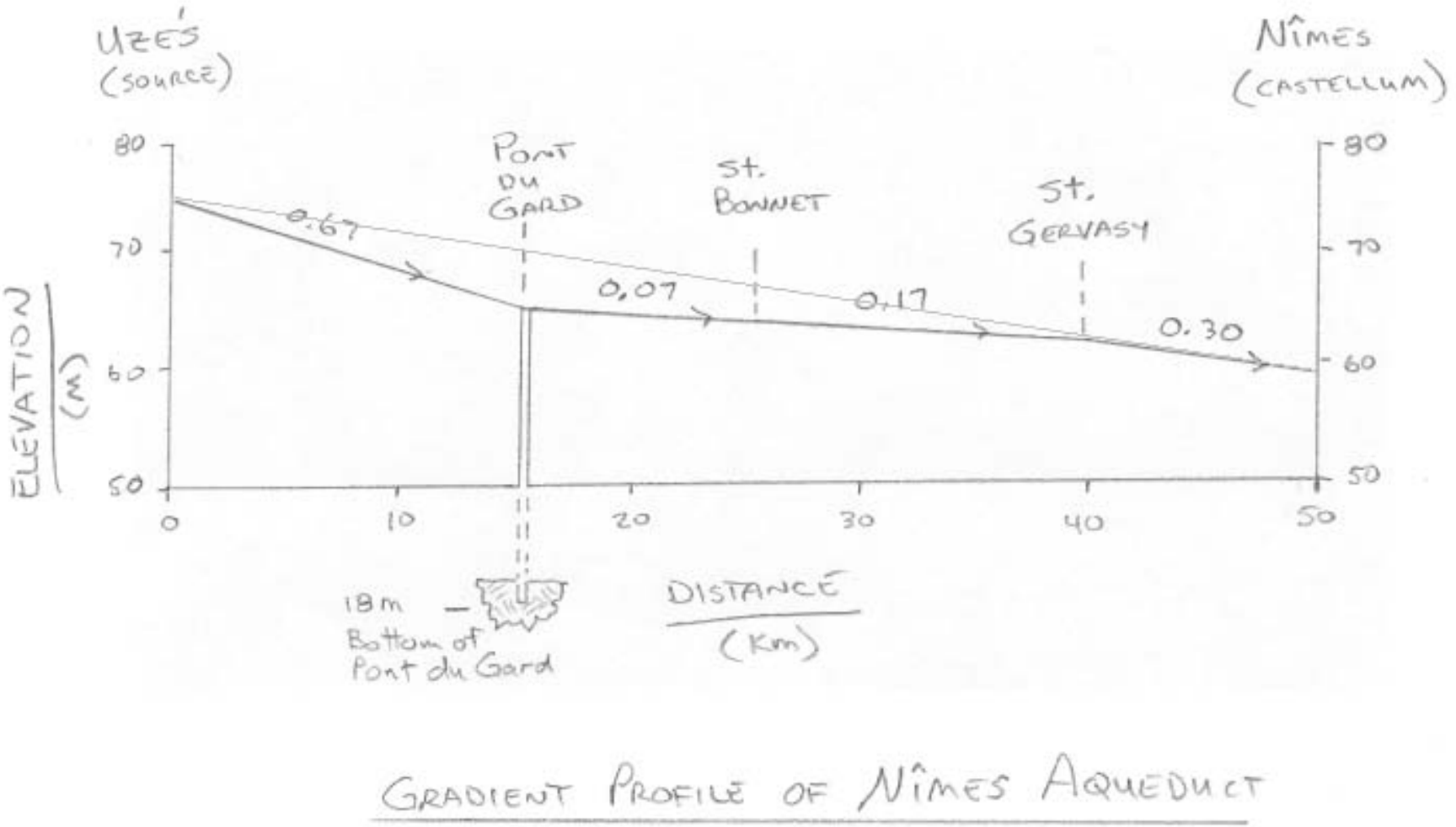
Design Considerations

- Nearest adequate drinking water source in Uzes which is 17 m higher in elevation than the castellum in Nimes
- Direct route is 20 km giving an ideal average gradient of .85 m/km
- But direct route is through 200 m high hills which would require a 10 km tunnel
- Going around the hills adds 30 km to route making the average gradient .34 m/km which is one-tenth the slope of some of Rome's aqueducts
- Must cross the River Gard at some point
- Need to stay as close to the average gradient line as possible since the slope is already so flat

The Route



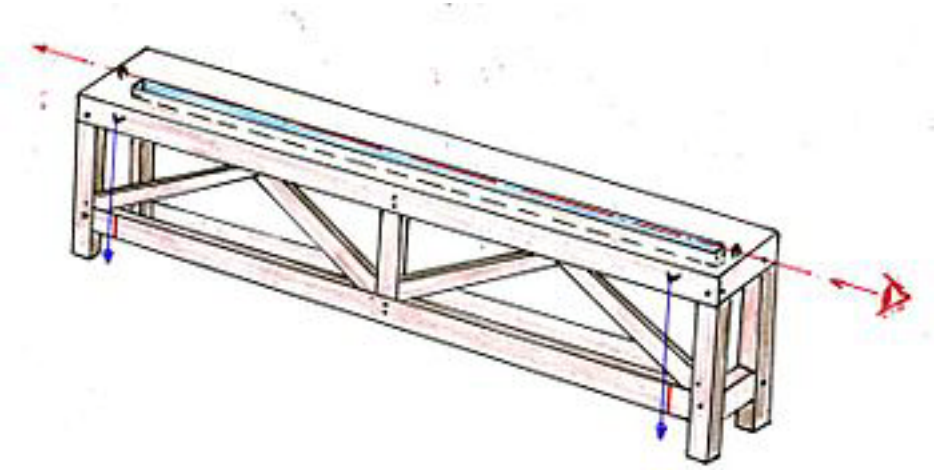
http://hist-archi.wikispaces.com/Pont+du+Gard



GRADIENT PROFILE OF NÎMES AQUEDUCT

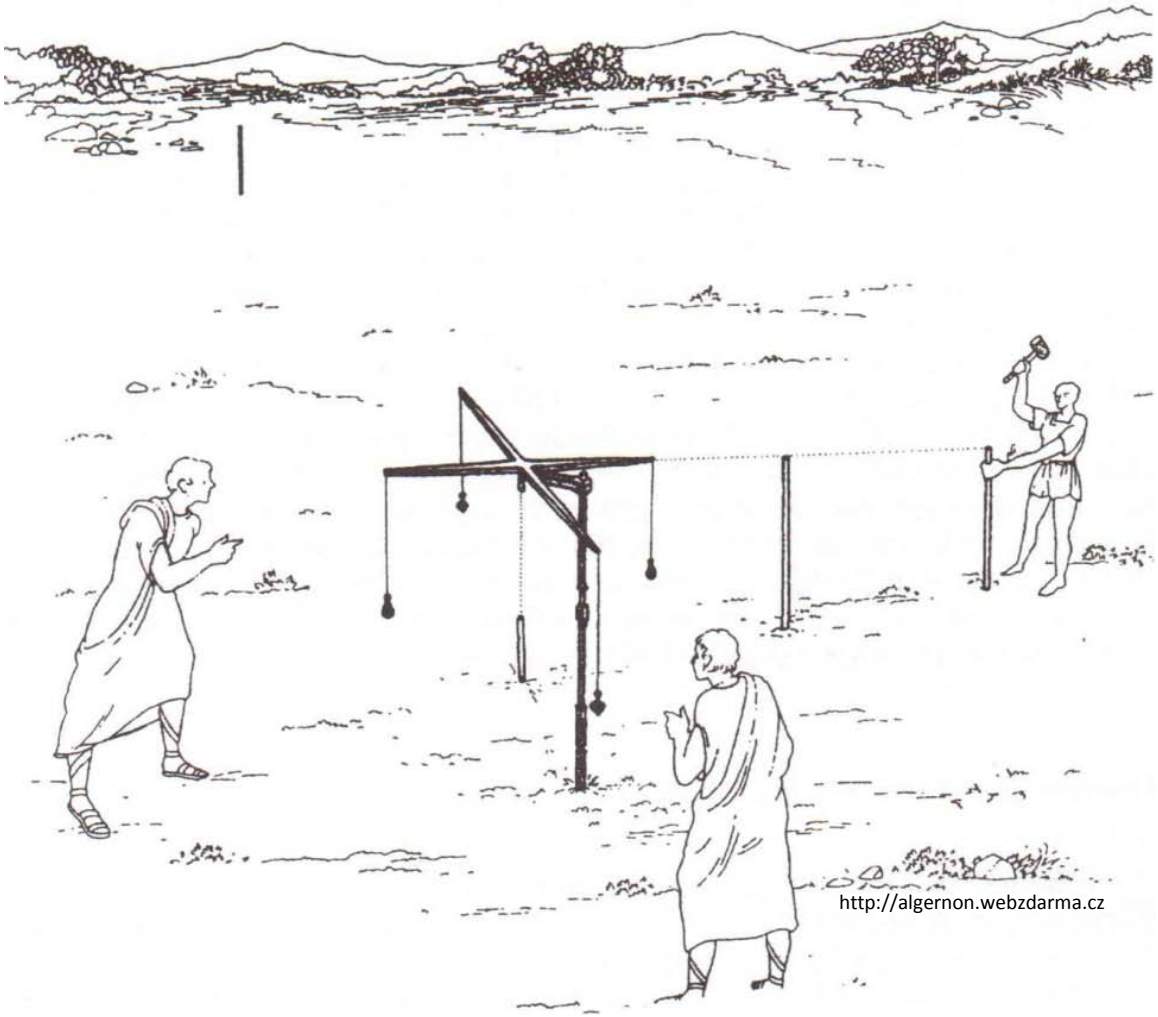
From Fig. 134 "Roman Aqueducts and Water Supplies" by A. Trevor Hodge

Surveying Instruments



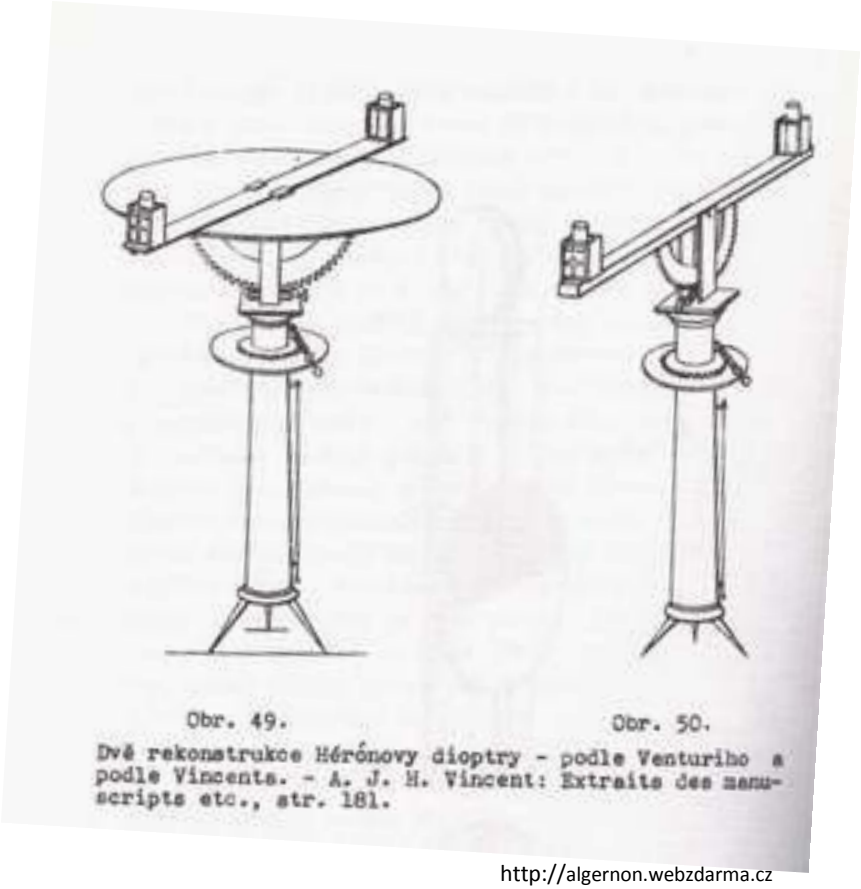
Chorobates – used to establish a true horizontal line

- narrow table 20 to 30 feet long and around 5 feet tall
- plumb bobs used to help level during set up
- water filled sighting trough along length of table



Groma – used to establish straight lines and right angles

- most common tool of a Roman surveyor
- primarily used to establish property lines
- could not be used to measure other angles, elevations, or establish a horizontal line



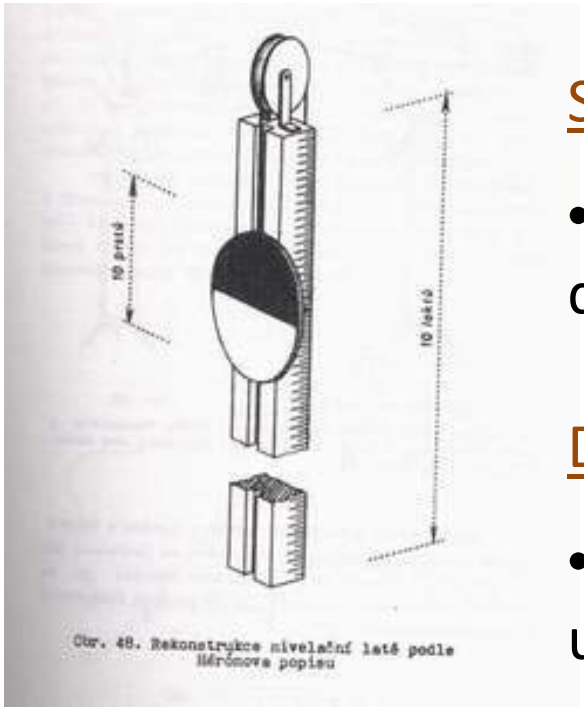
Obr. 49. Obr. 50.

Dvě rekonstrukce Hérónovy dioptry - podle Venturiho a podle Vincenta. - A. J. H. Vincent: Extraits des manuscripts etc., str. 181.

http://algernon.webzdarma.cz

Dioptra – used to measure horizontal and vertical angles

- similar to the modern theodolite



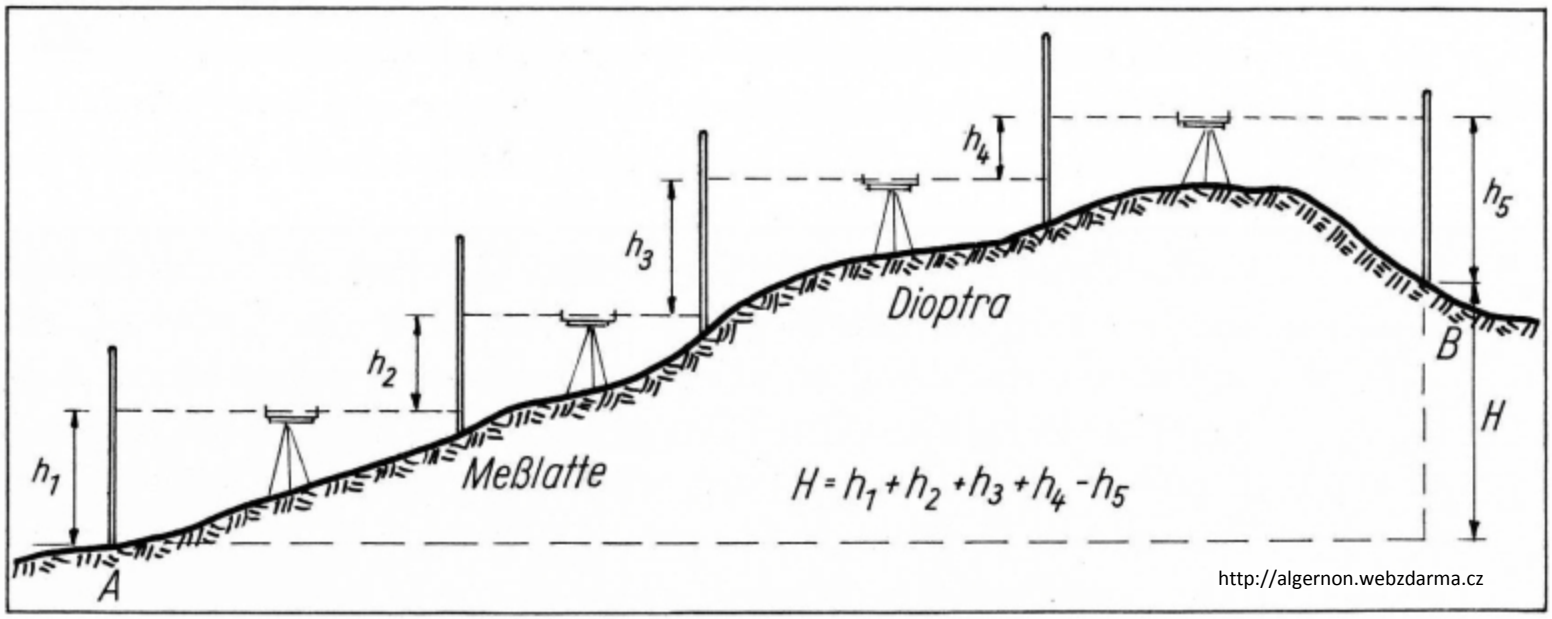
Obr. 48. Rekonstrukce nivelační latě podle Héronova popisu

Sighting Rod – used measure vertical distances

- used in conjunction with a chorobates or diopra to determine elevation differences

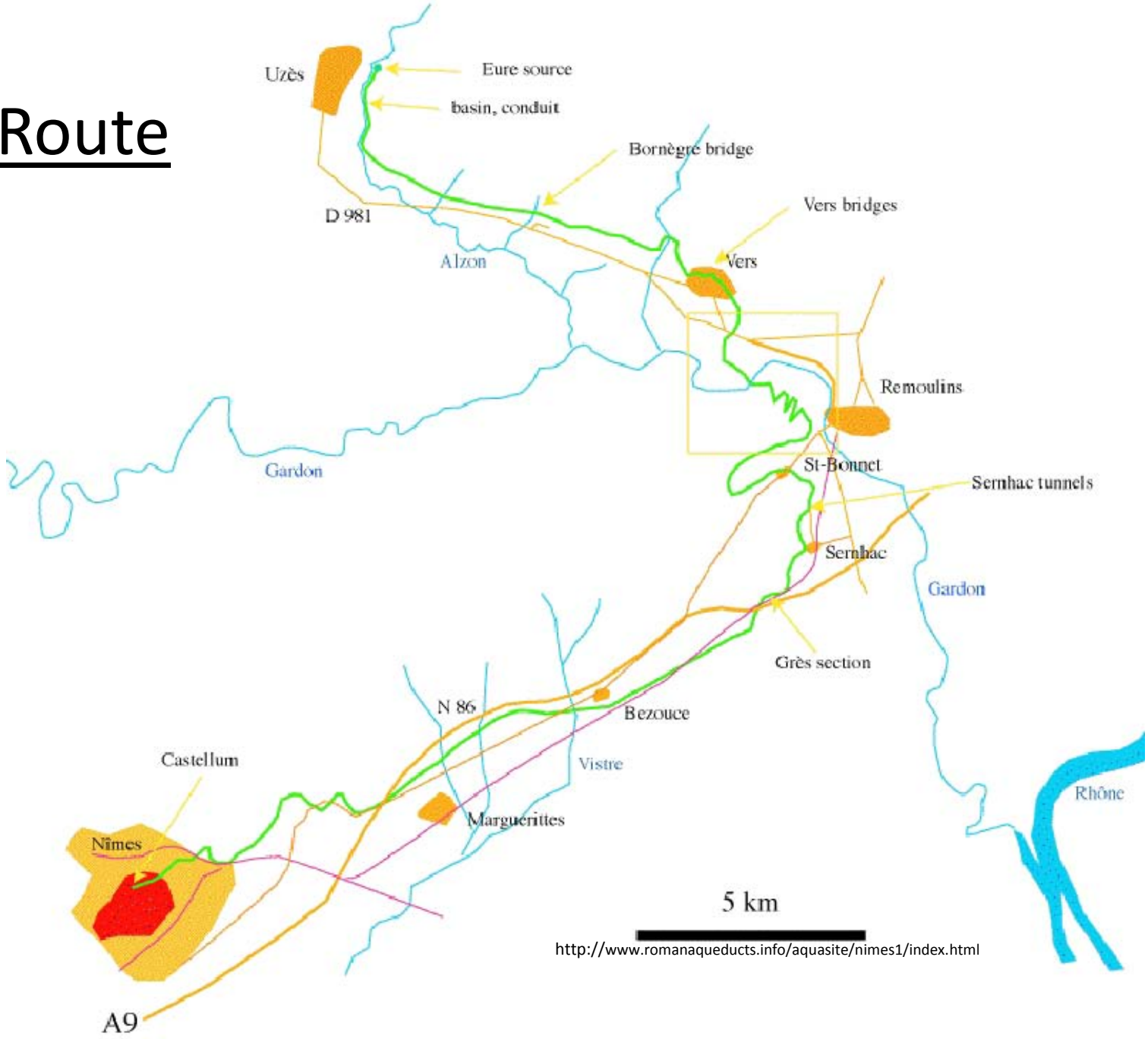
Decempeda - Latin for 'ten feet‘

- a graduated measuring rod of ten Roman feet used to measure distance



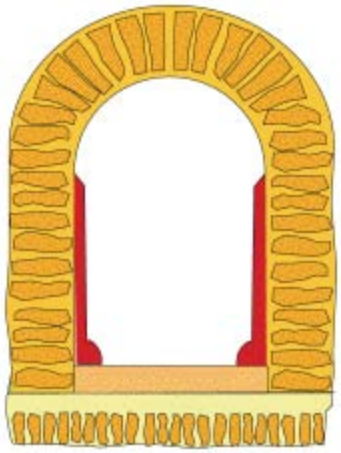
http://algernon.webzdarma.cz

The Route



http://www.romanaqueducts.info/aquasite/nimes1/index.html

Waterworks Structures

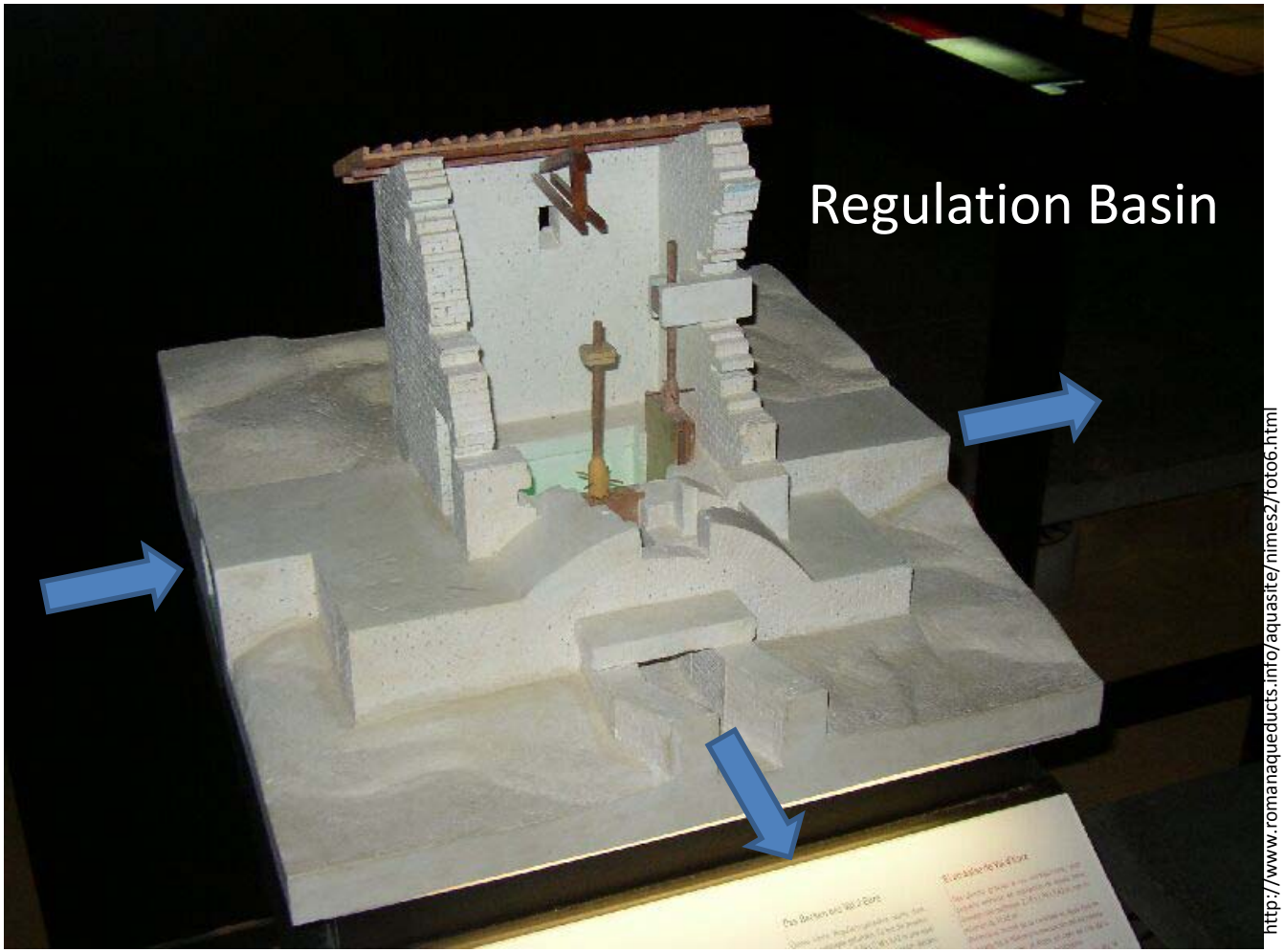


http://www.romanaqueducts.info/aquasite/nimes1/foto8.html

http://www.romanaqueducts.info/aquasite/nimes2/foto2.html

Covered surface channels like this comprised 80 to 90 percent of the total mileage of all Roman aqueducts.

Regulation Basin in Uzes



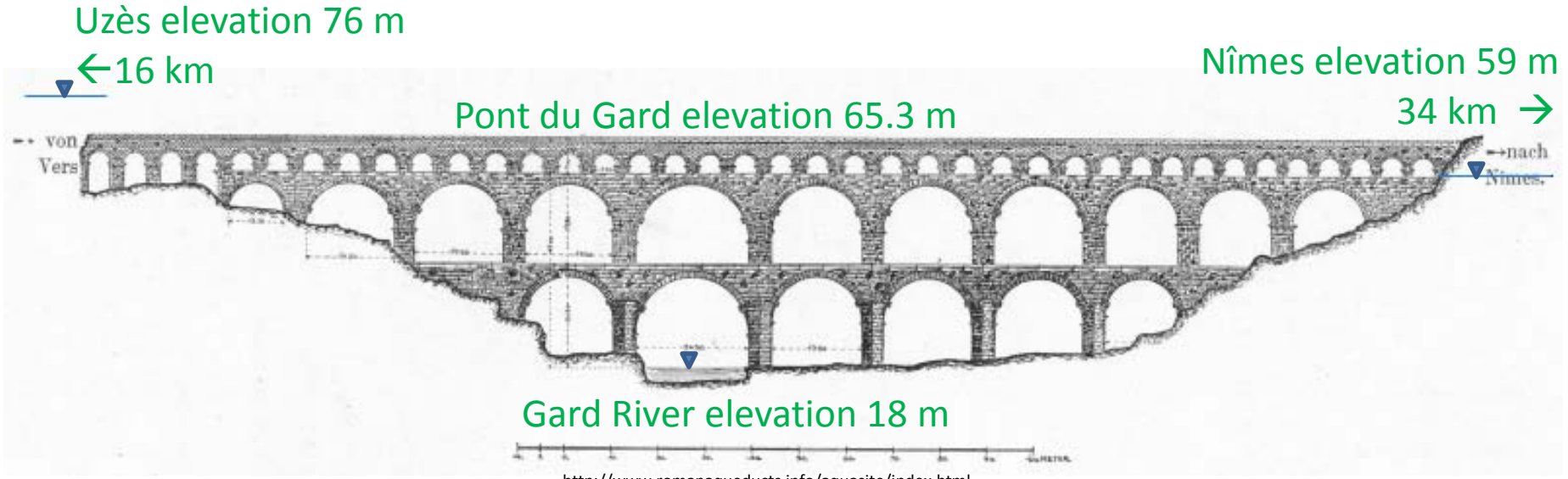
http://www.romanaqueducts.info/aquasite/nimes2/foto6.html

Pont de la Lône Arcade

Sinter Deposit

Pont du Gard – looking upstream

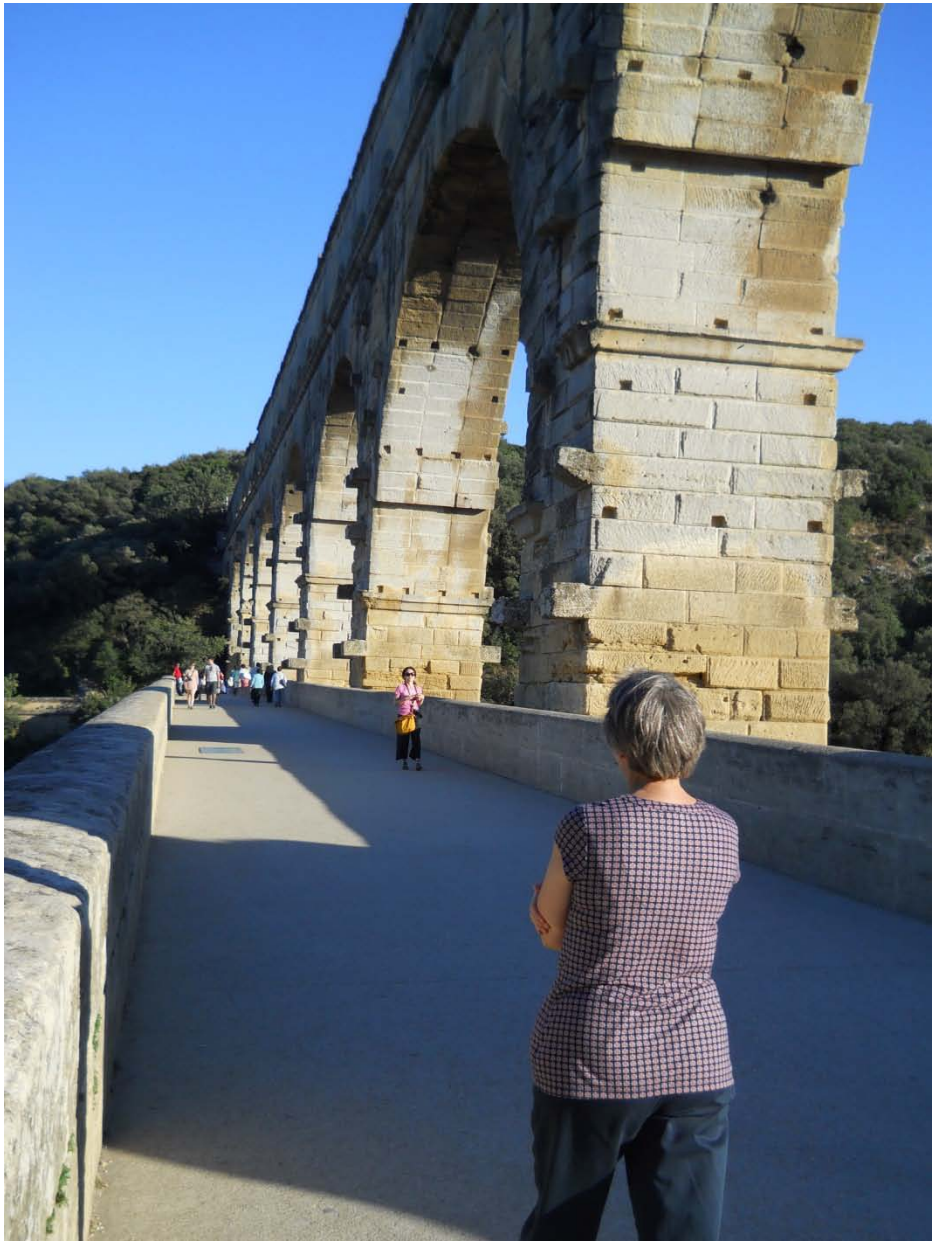
Pont du Gard



http://www.romanaqueducts.info/aquasite/index.html

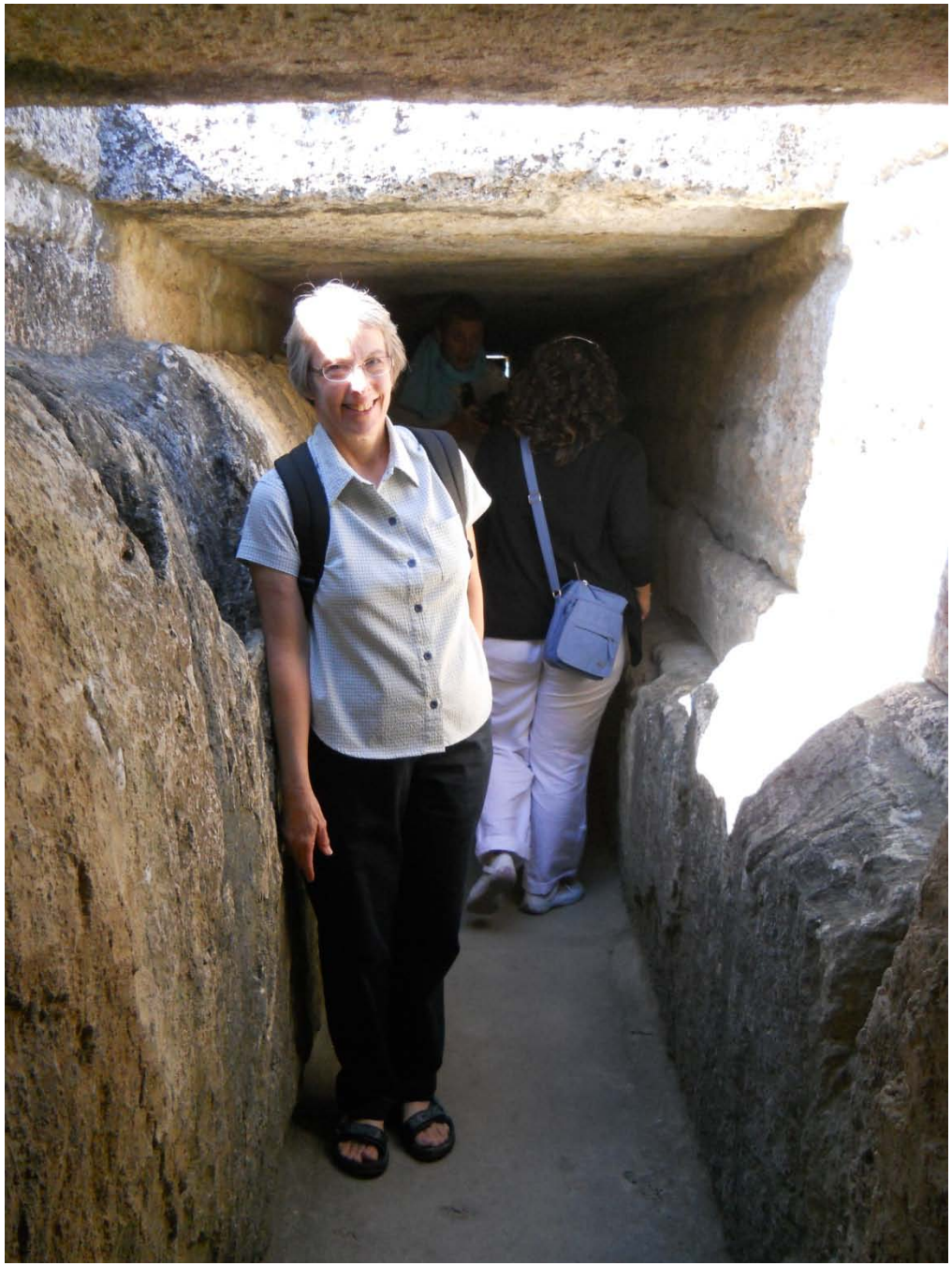
Pont du Gard Facts:

* Completed around 50 AD
* Highest bridge ever built by the Romans – 48.77 m (160 ft) above the river bed
* Length – 275 m (902 ft)
* Maximum span – 24.52 m (80 ft) span across the Gard River
* Conduit 1.25 m wide by 1.85 m high (4.1 ft x 6.1 ft)
* Road bridge added by the French hydraulic engineer Henri Pitot in 1743-1747



Crossing Pitot’s Bridge

In the conduit



Looking upstream

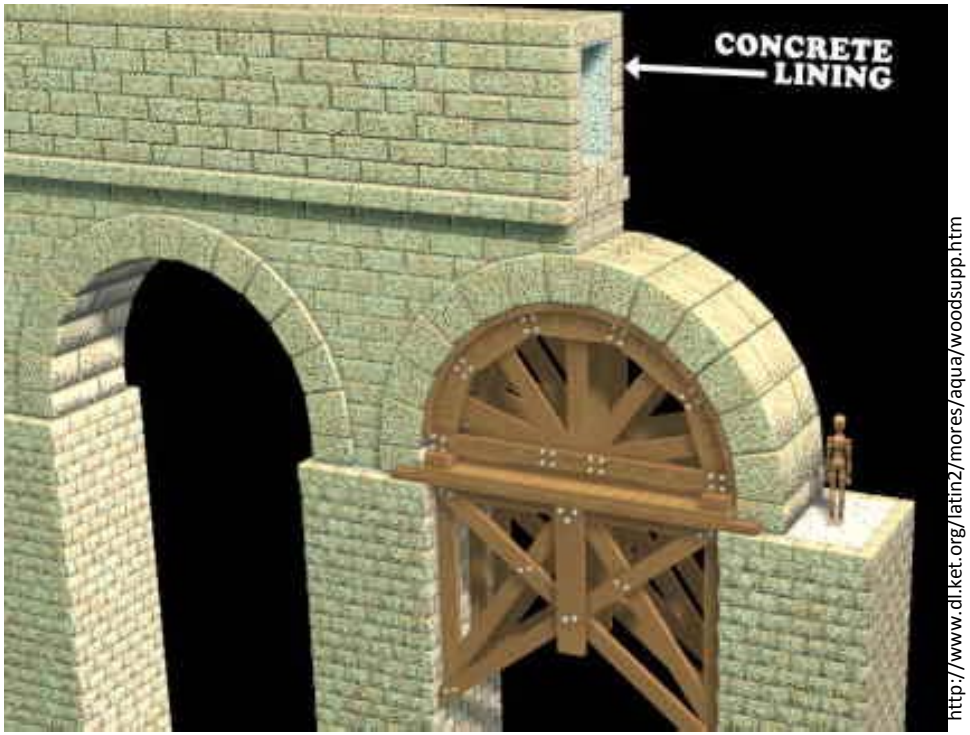
Castillon Du-Gard

Looking downstream

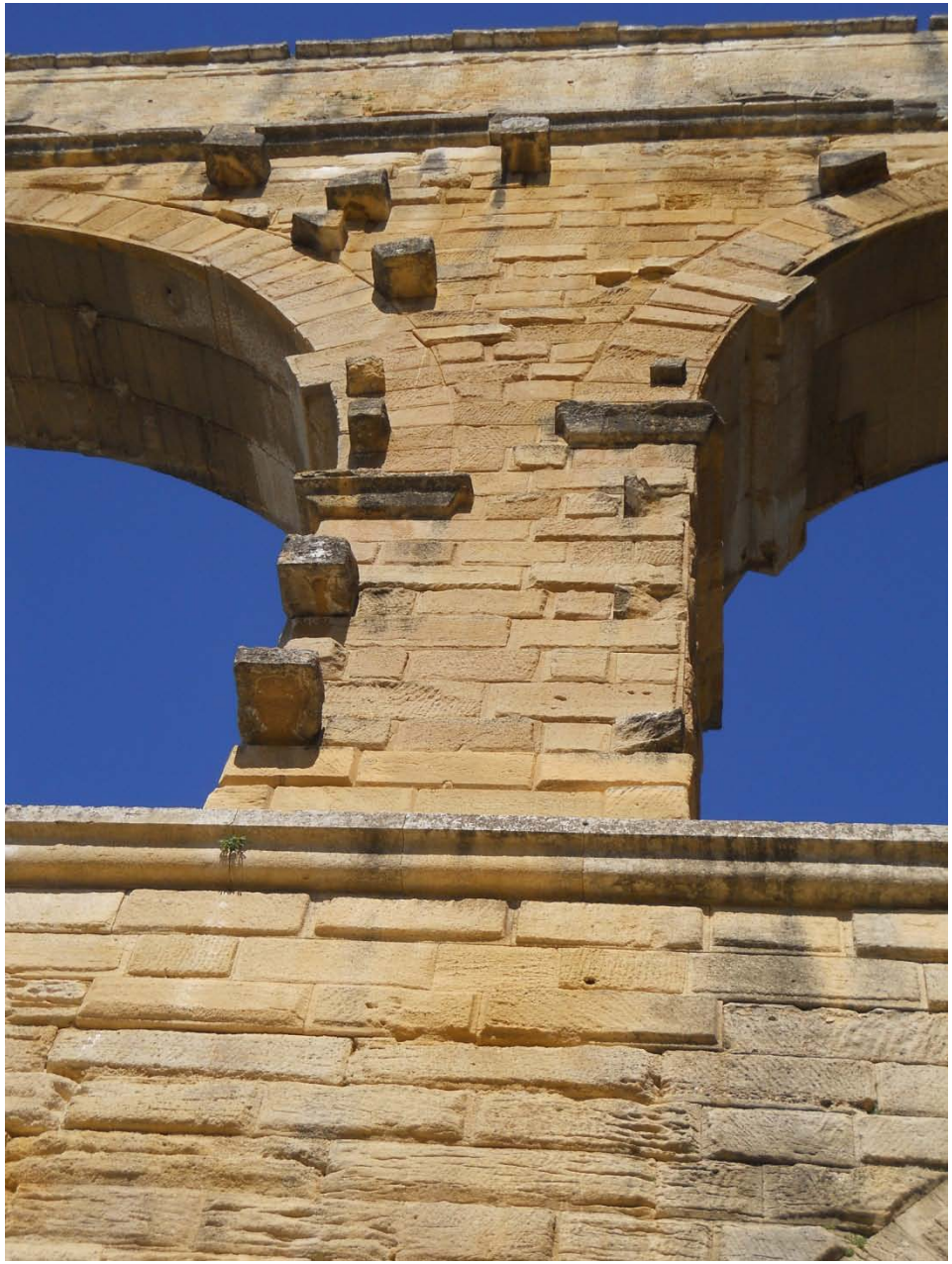
View from Castillon-du-Gard

Castillon-du-Gard, France

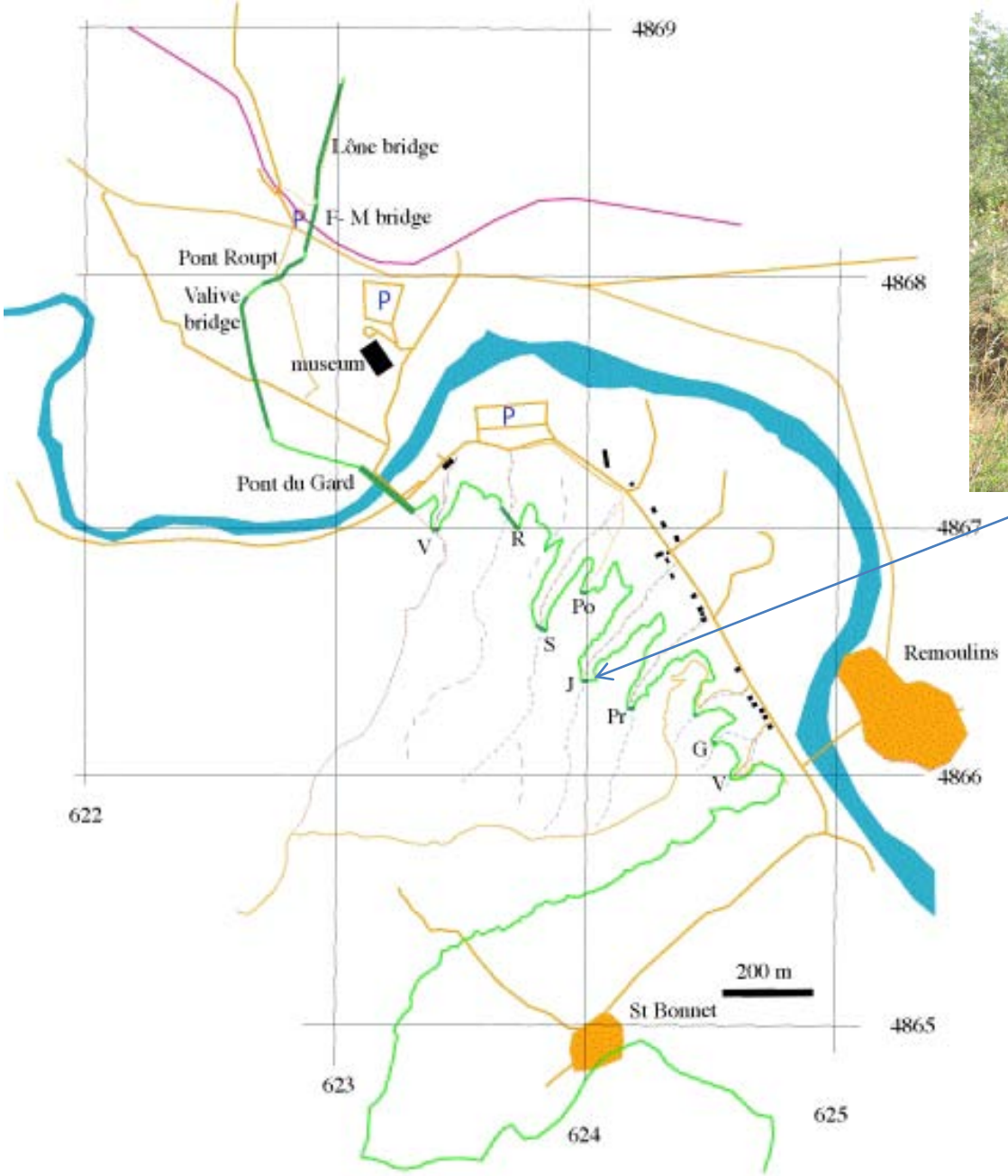
The Gard River



http://www.dl.ket.org/latin2/mores/aqua/woodsupp.htm



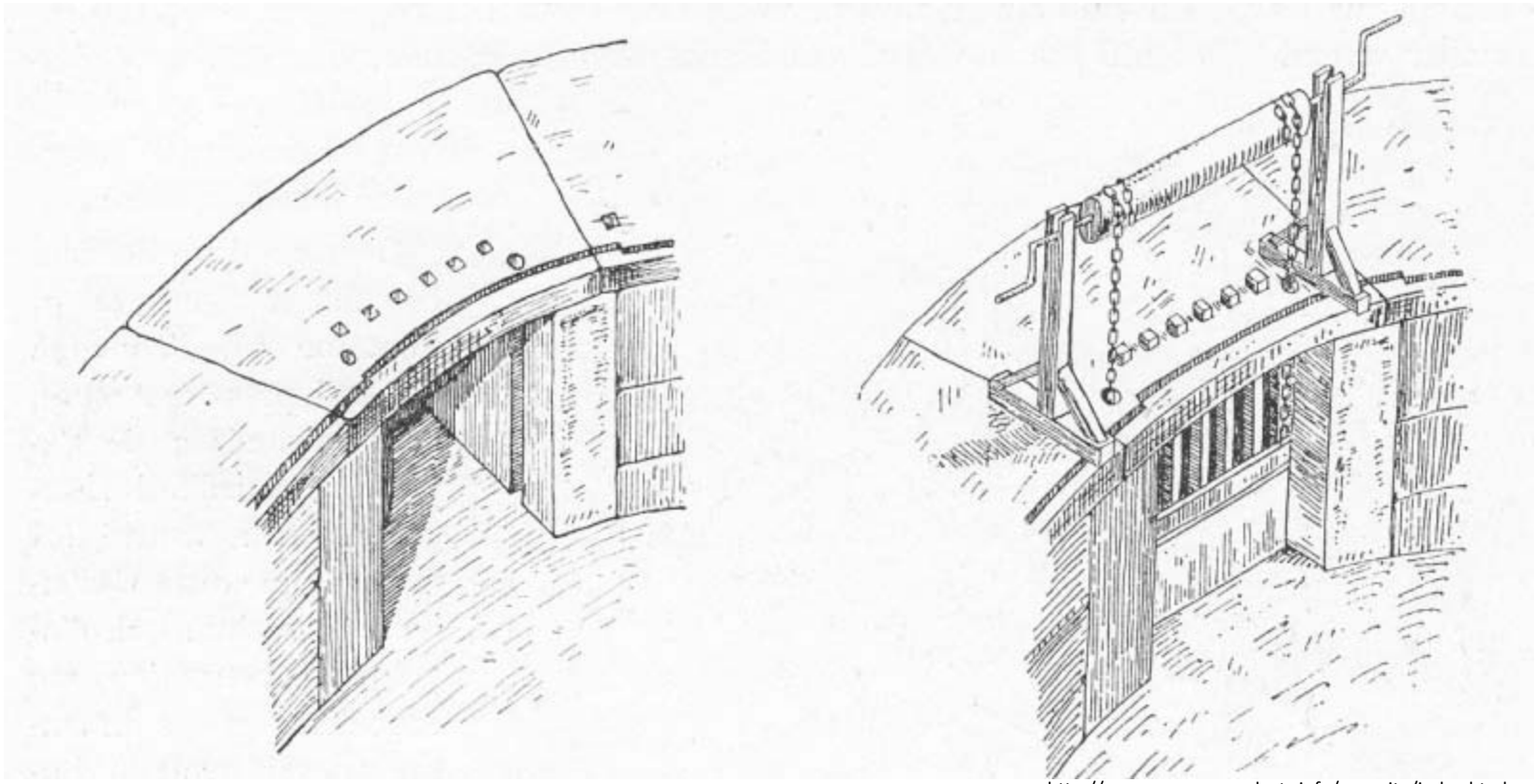
Vers Pont du Gard Rock Quarry



Joseph Bridge

Castellum in Nimes

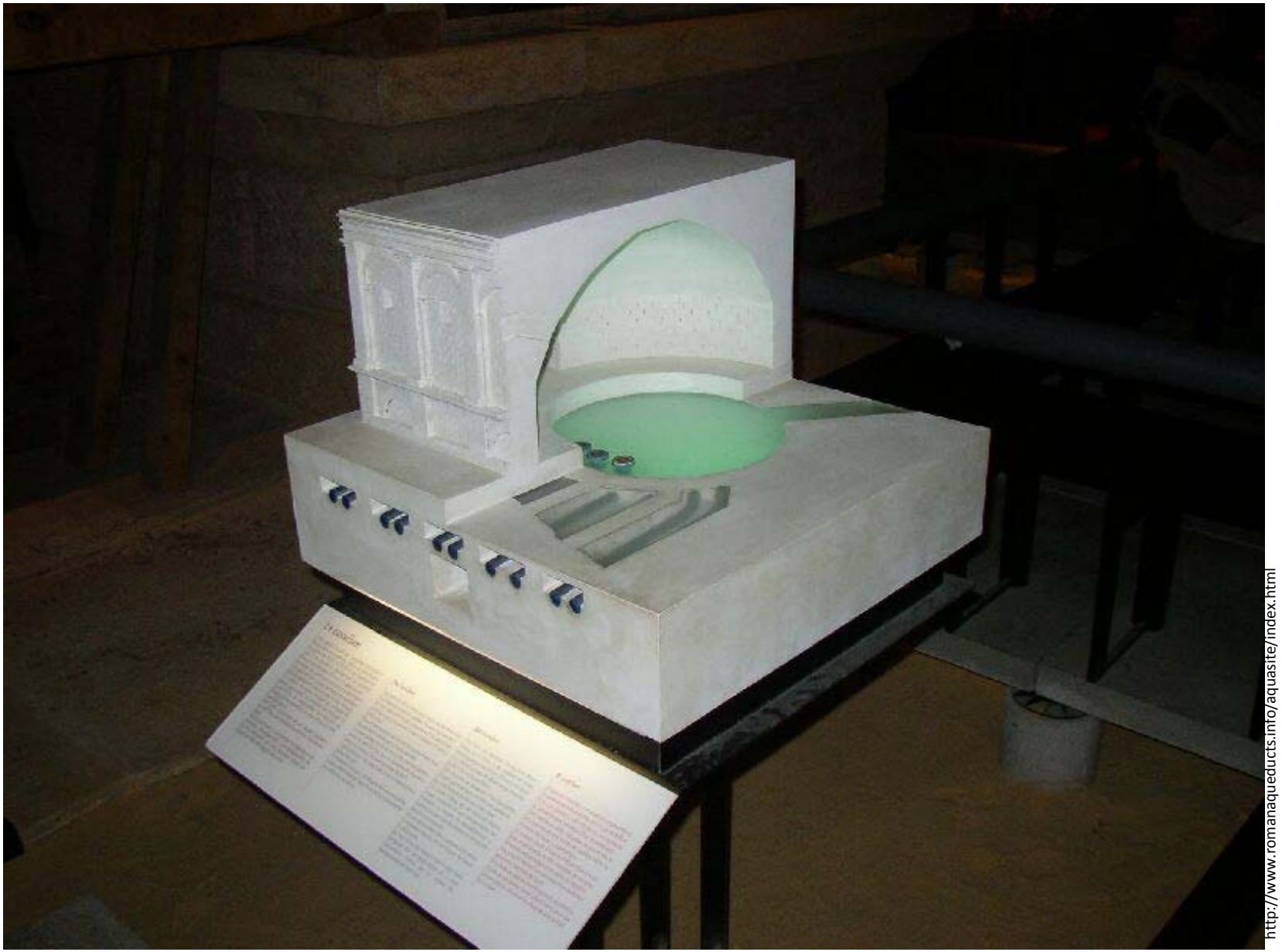
Castellum



http://www.romanaqueducts.info/aquasite/index.html

Water Control Gate

http://www.romanaqueducts.info/aquasite/index.html



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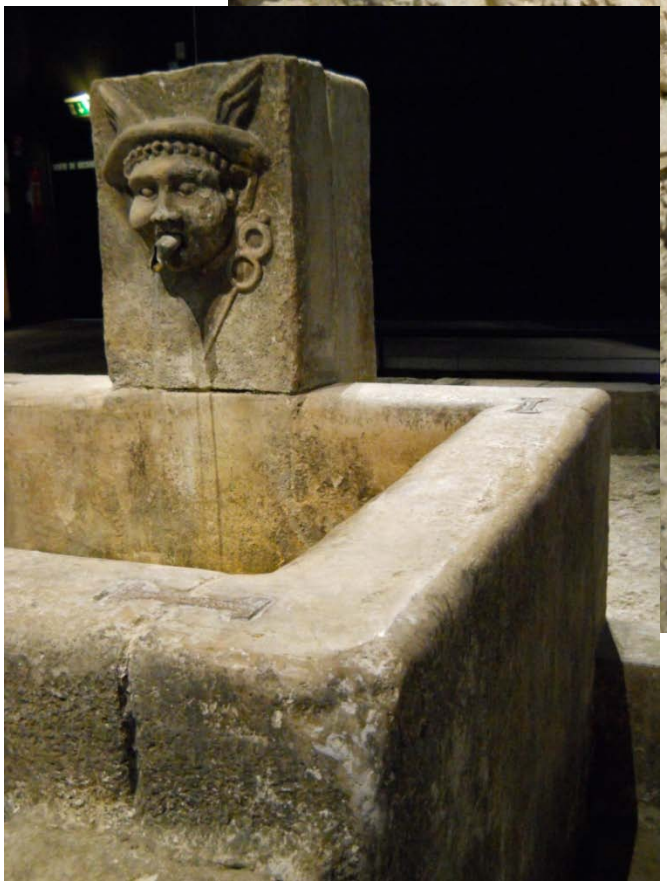

http://www.romanaqueducts.info/aquasite/index.html

http://en.wikipedia.org

Roman Toilets in Ostia Antica - Rome

http://en.wikipedia.org

Roman baths in Bath, England

Quid vultis agnoscere?

(What else do you want to know?)