EGS – AGU - EUG Joint Assembly, Nice, France, April 2003

Session HS9 - Sediment dynamics and channel change in rivers and estuaries

Channel change and sediment movement after a major level drawdown at Kremasta reservoir, Western Greece

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Brief outline of the presentation

- **Hydrographic survey of Kremasta reservoir, western Greece (1998-99)**
- **Extraction of two sedimentary cores at the mouth of Acheloos river (September 2001)**
- **Development of erosion processes due to a significant reservoir stage drawdown during the two year period**
- **Laboratory analyses of extracted samples of deposited sediments (e.g. granulometry, mineralogy, particle characterization, statistical analysis)**
- **Conclusions upon the influence of the recent drawdown on sediment stratification**

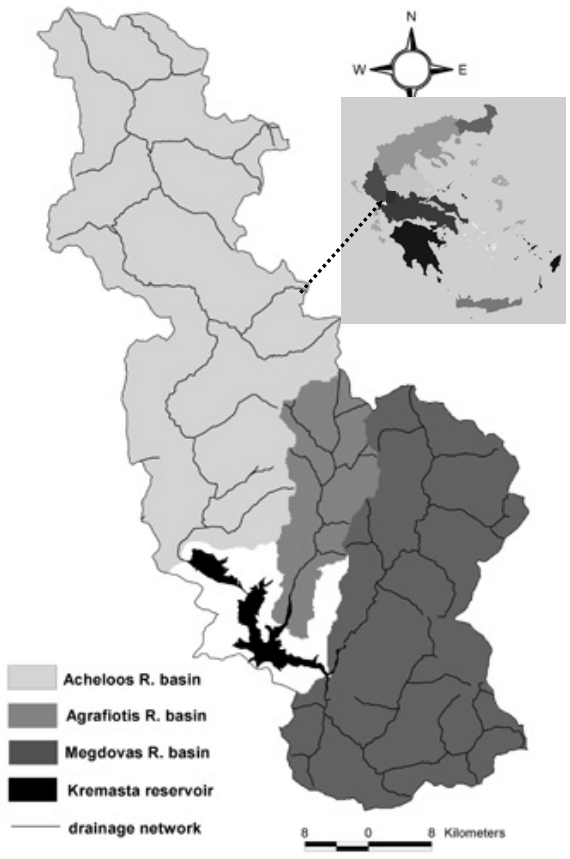
Objectives of the presentation

- **Description of a significant channel erosion during the time interval between the hydrographic survey of the reservoir and the extraction of the sedimentary cores**
- **Understanding the erosion mechanism as a result of the reservoir stage drawdown and incoming water yield**
- **Reconstructing the depositional environment of the reservoir from "signatures" in the deposited sediments (e.g. poorly graded sediments means not depositional environment possibly due to low reservoir stage)**

RESEARCH PROJECT

"Appraisal of river sediments' deposits in reservoirs of hydropower dams"
Funded by the Greek Secretariat of Research and Technology (GSRT) and the Public Power Corporation (PPC)

Final report freely available: *http://www.itia.ntua.gr/e/docinfo/*



Kremasta reservoir & watershed

Kremasta reservoir

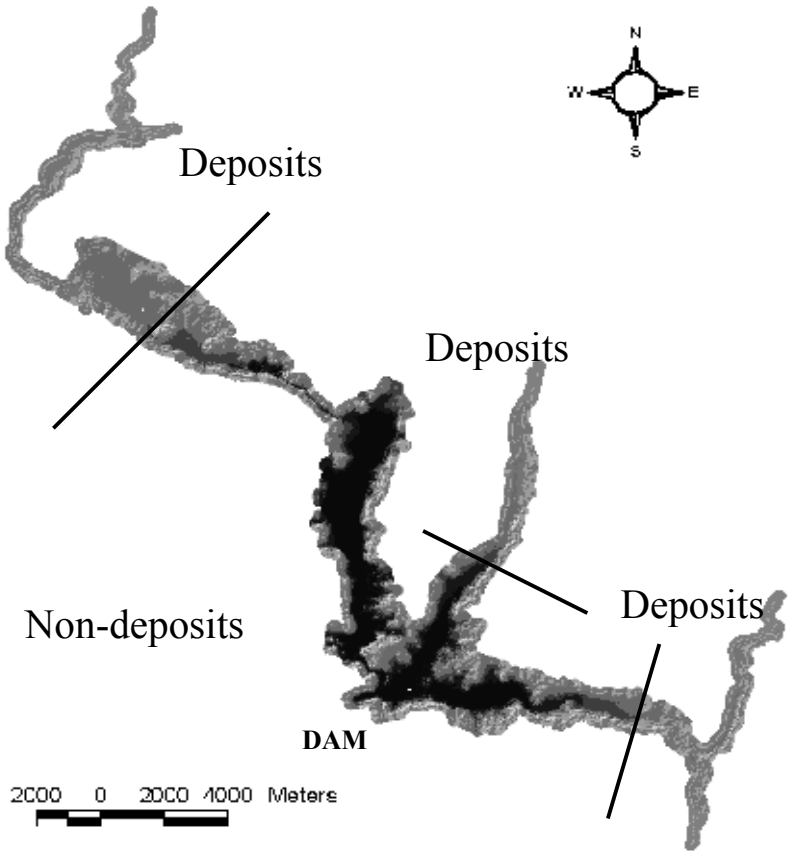
- **Surface at the overflow stage: 80.6 km^2**
- **Total volume of stored water: 4495 hm^3**

Kremasta reservoir watershed

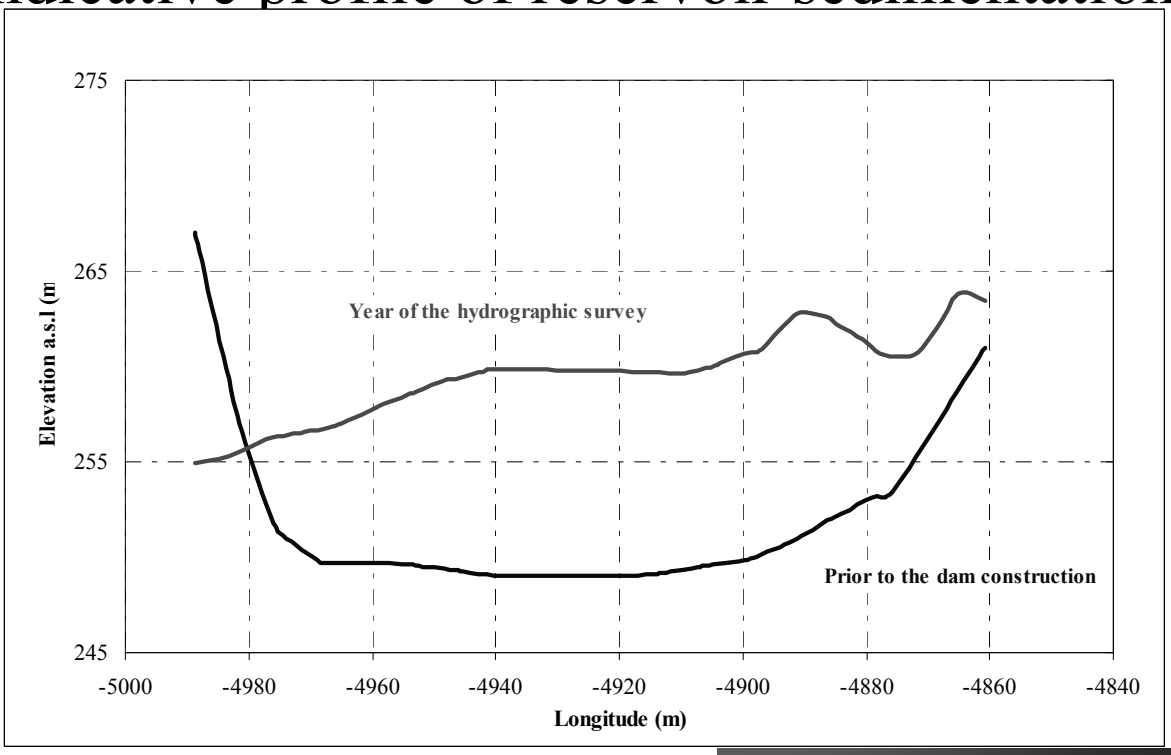
- **Area: 3292 km^2**
- **Mean annual rainfall: 1433 mm**
- **Mean annual runoff: 117.1 m^3/s**
- **Absolute elevations: min +284m , max+2433m**

Hydrographic survey of Kremasta reservoir

Determination of reservoir segments with sediment deposits

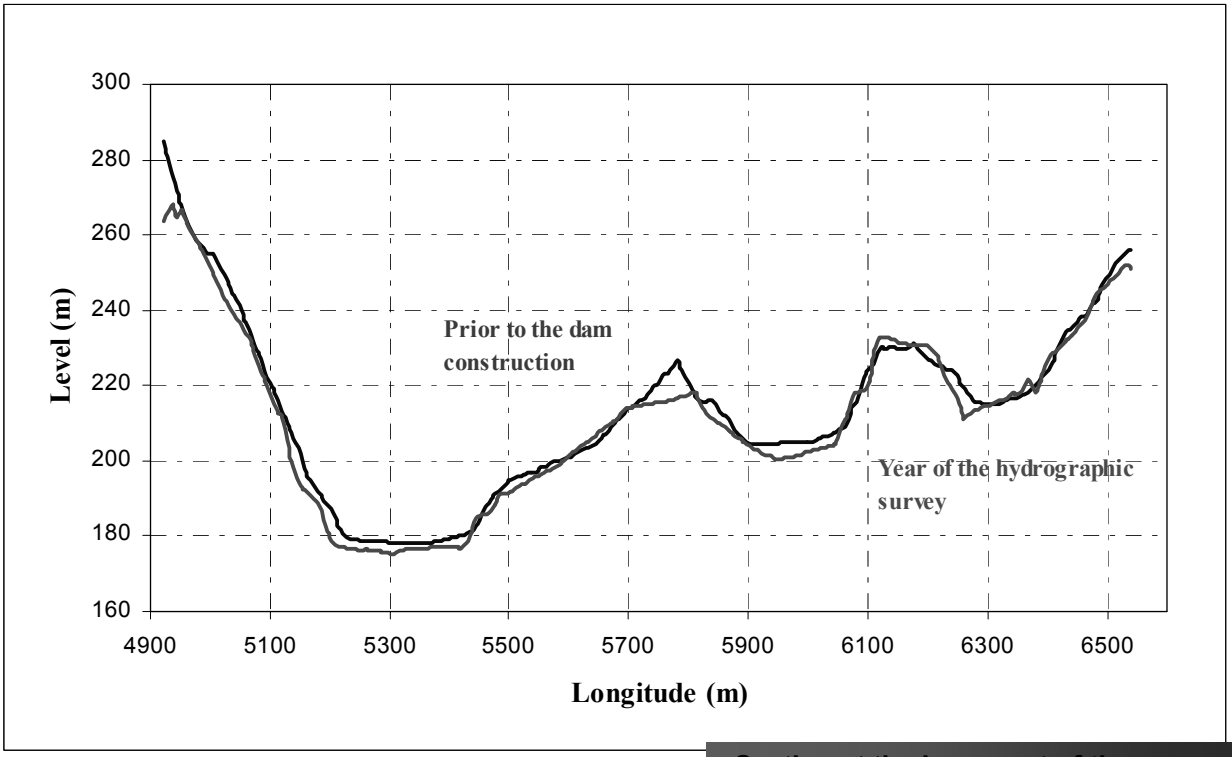


Indicative profile of reservoir sedimentation



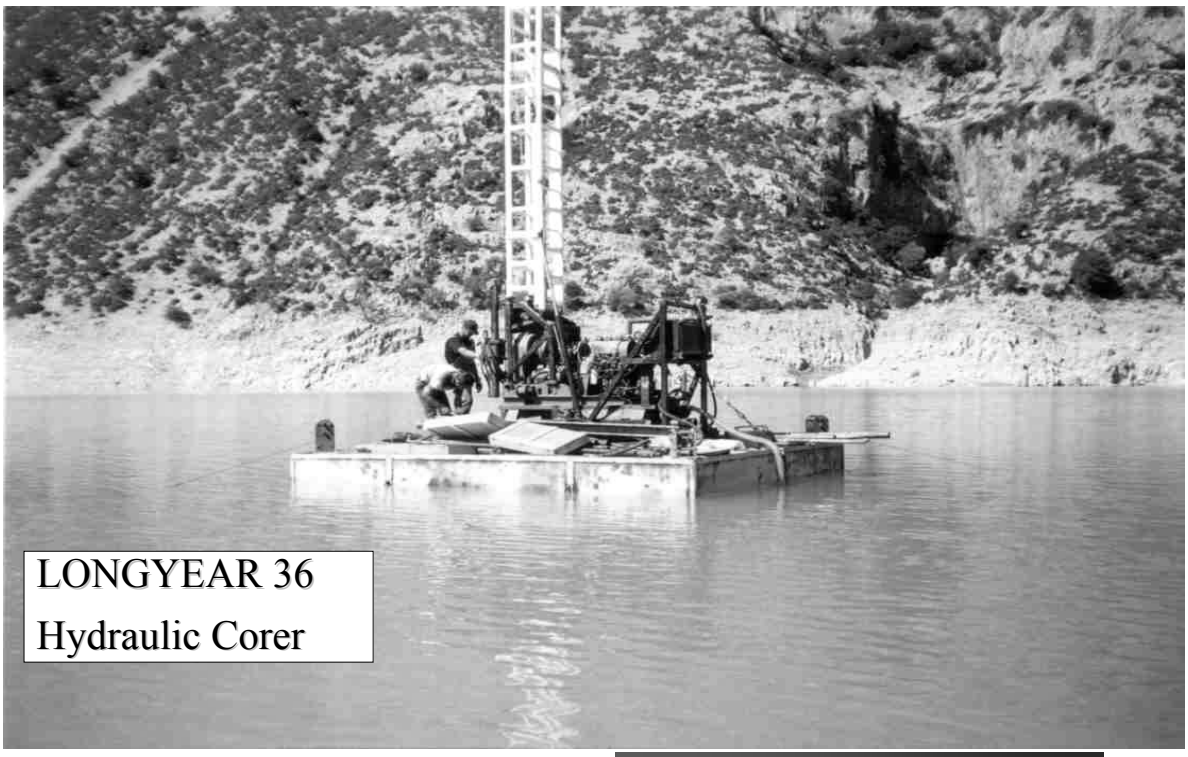
Acheloos R. at the reservoir delta

Indicative profile of reservoir sedimentation



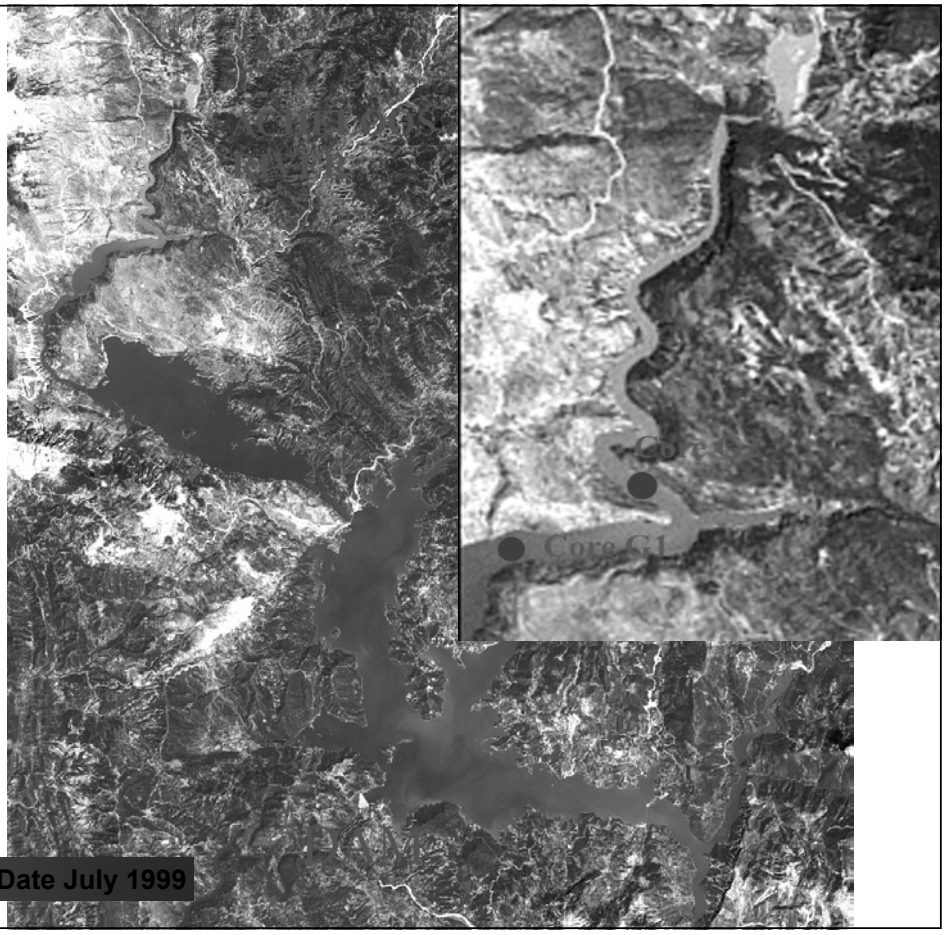
Section at the inner part of the reservoir

Core samples extraction



September 2001

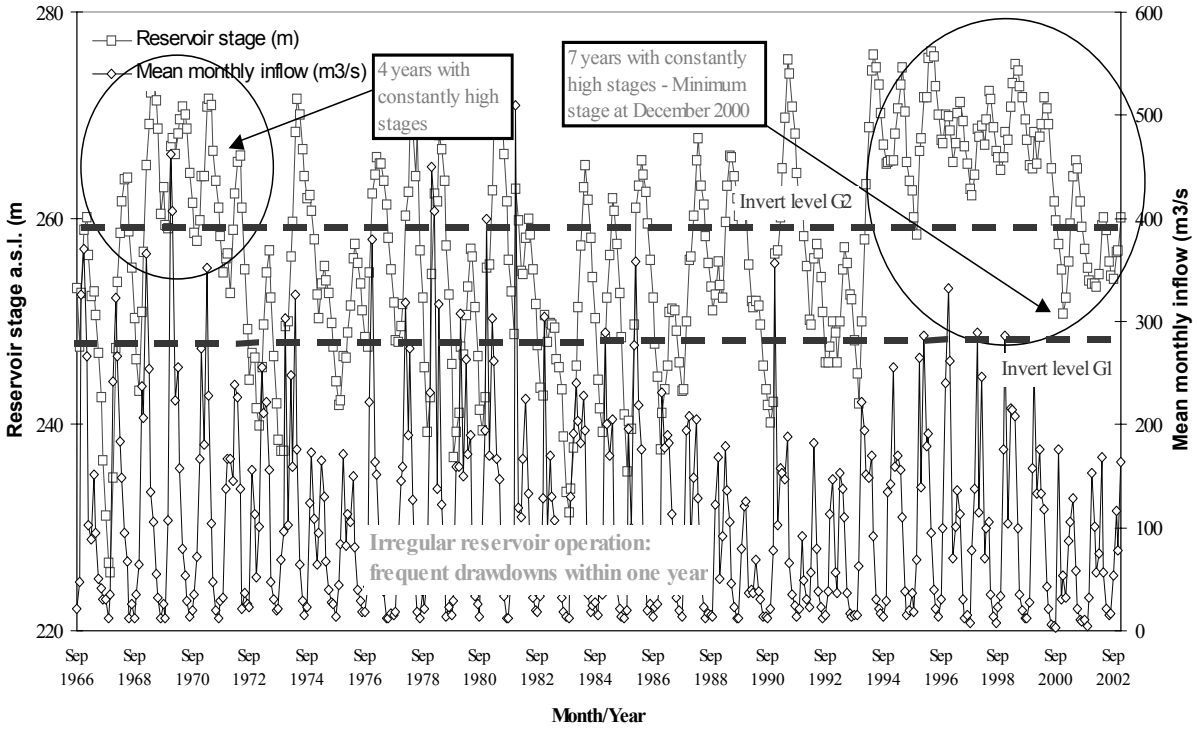
Sites of core samples extraction



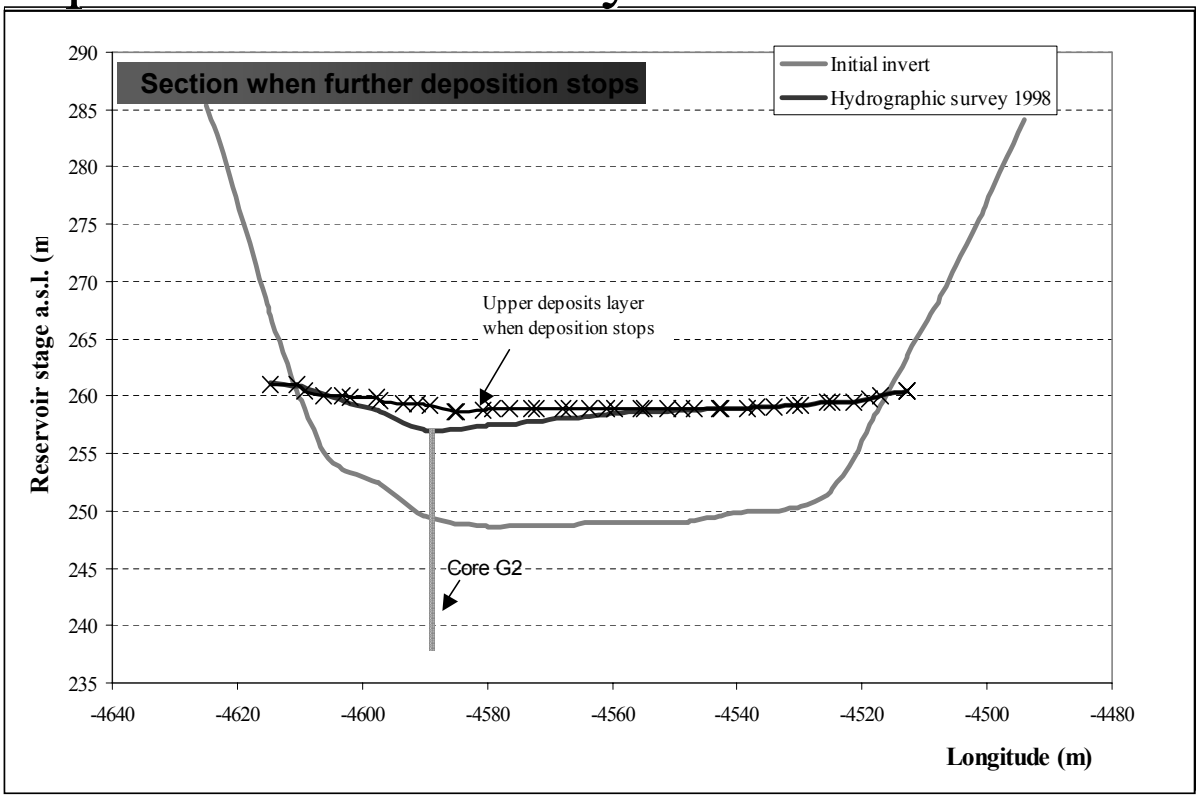
LANDSAT ETM+ IMAGE: Date July 1999

Reservoir level drawdown

Variation of reservoir stage and water inflow

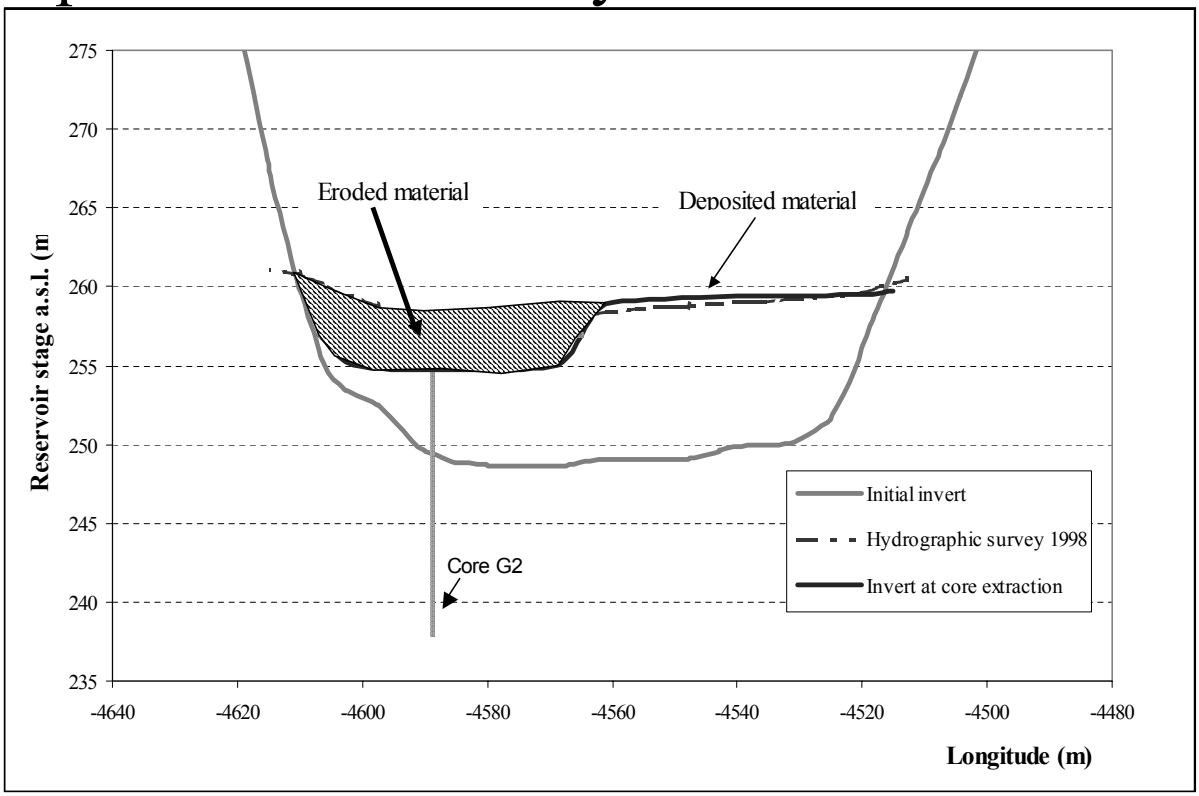


Upstream sedimentary core G2

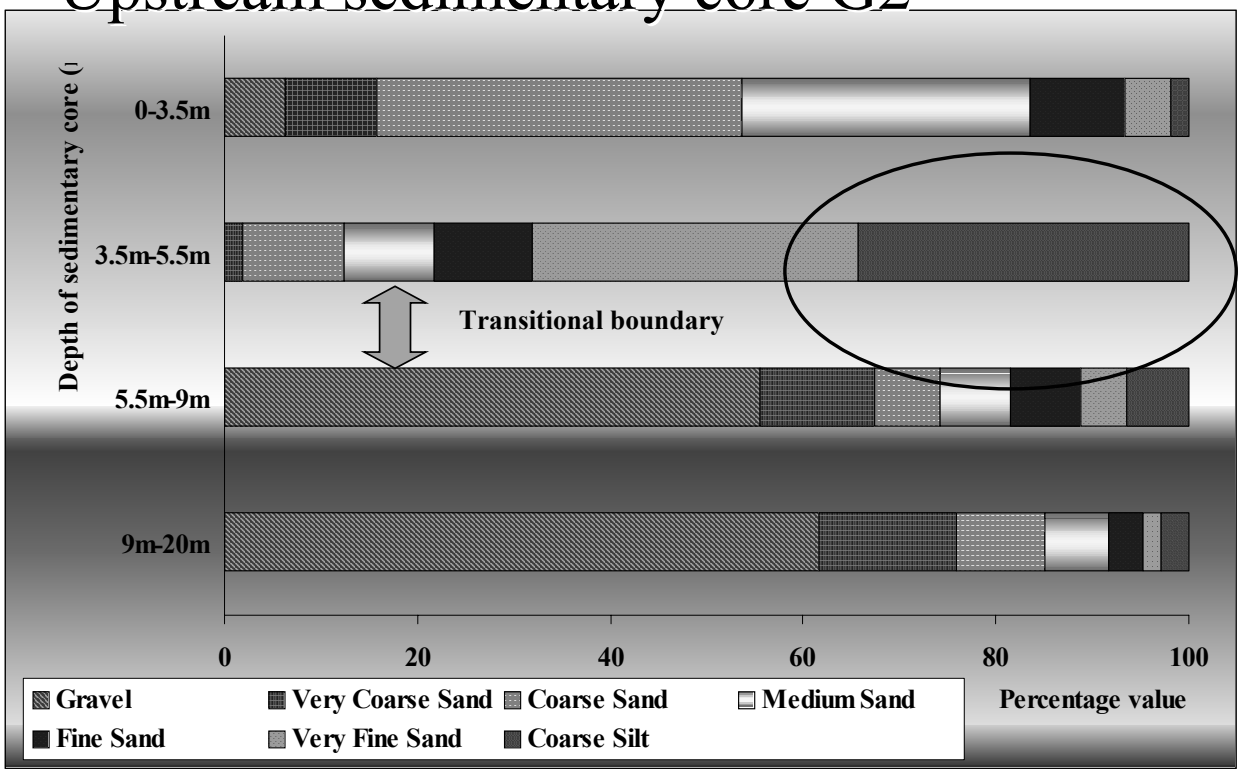


Erosion process of deposited sediments

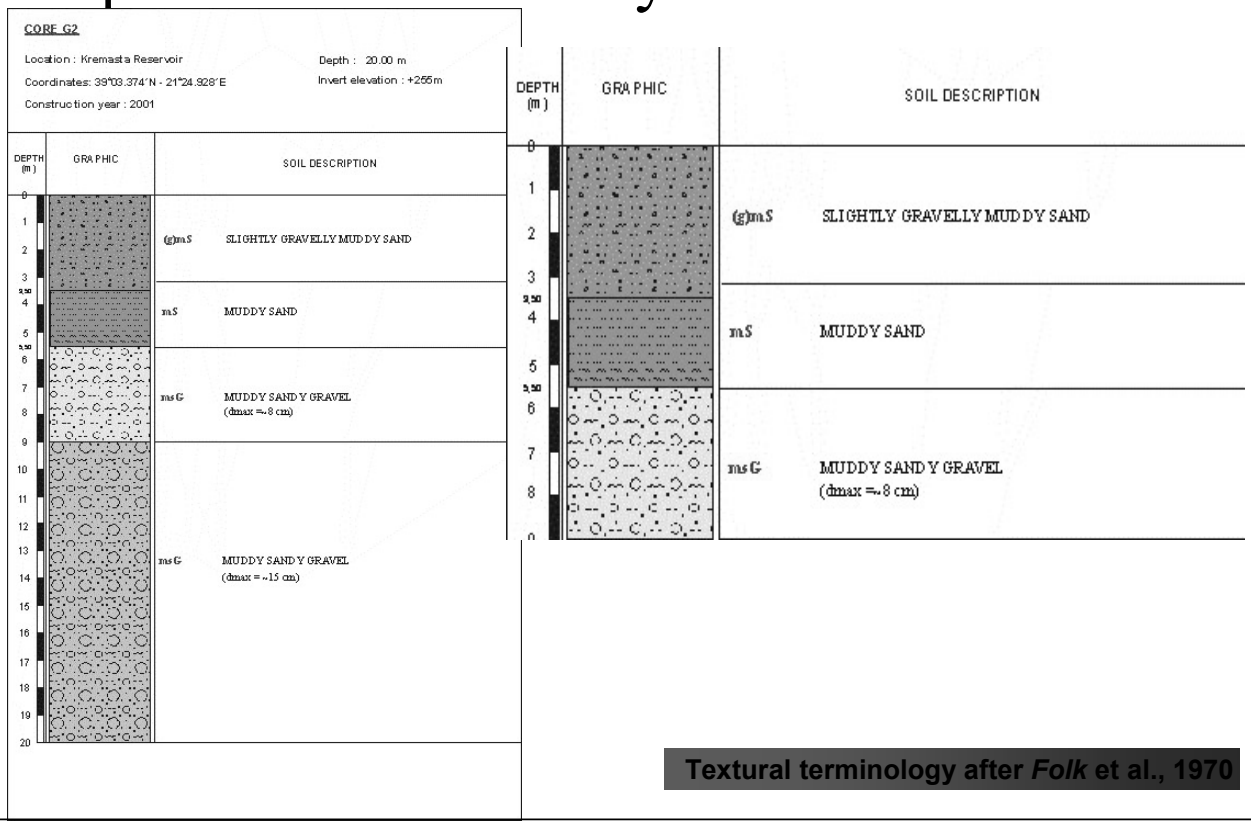
Upstream sedimentary core G2



Upstream sedimentary core G2

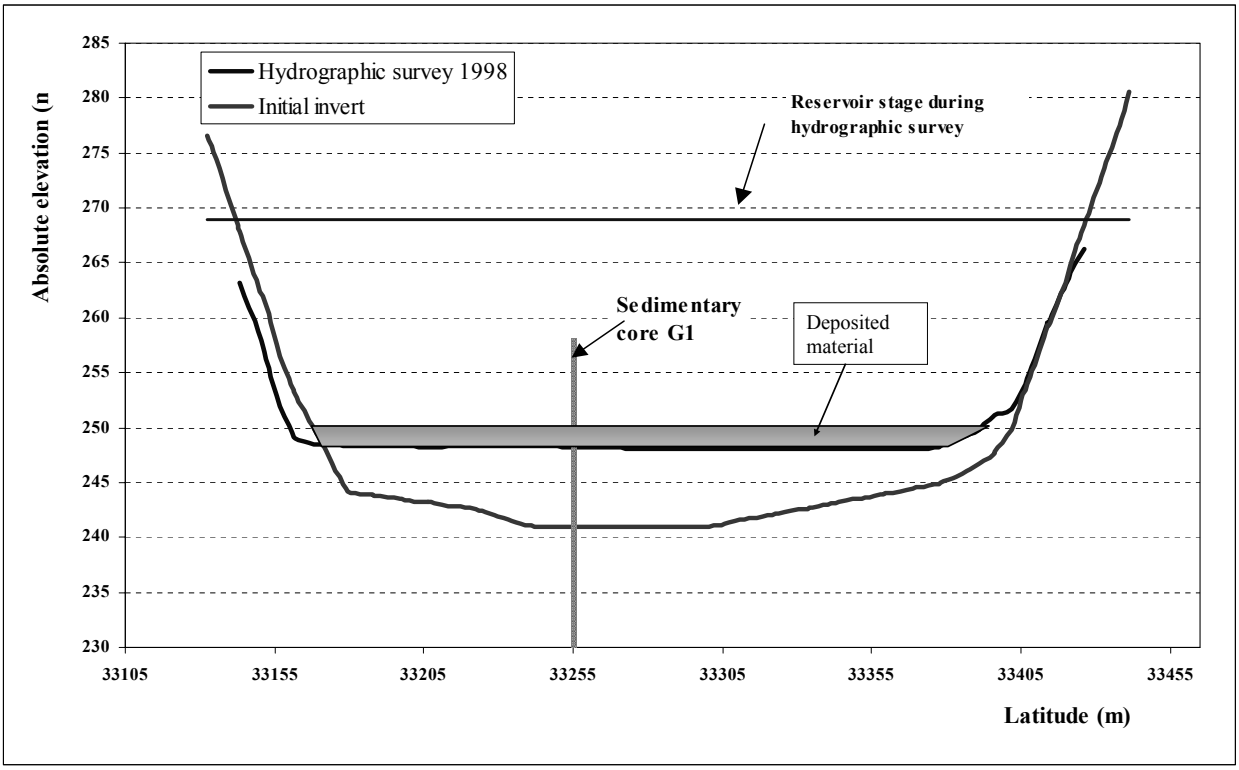


Upstream sedimentary core G2

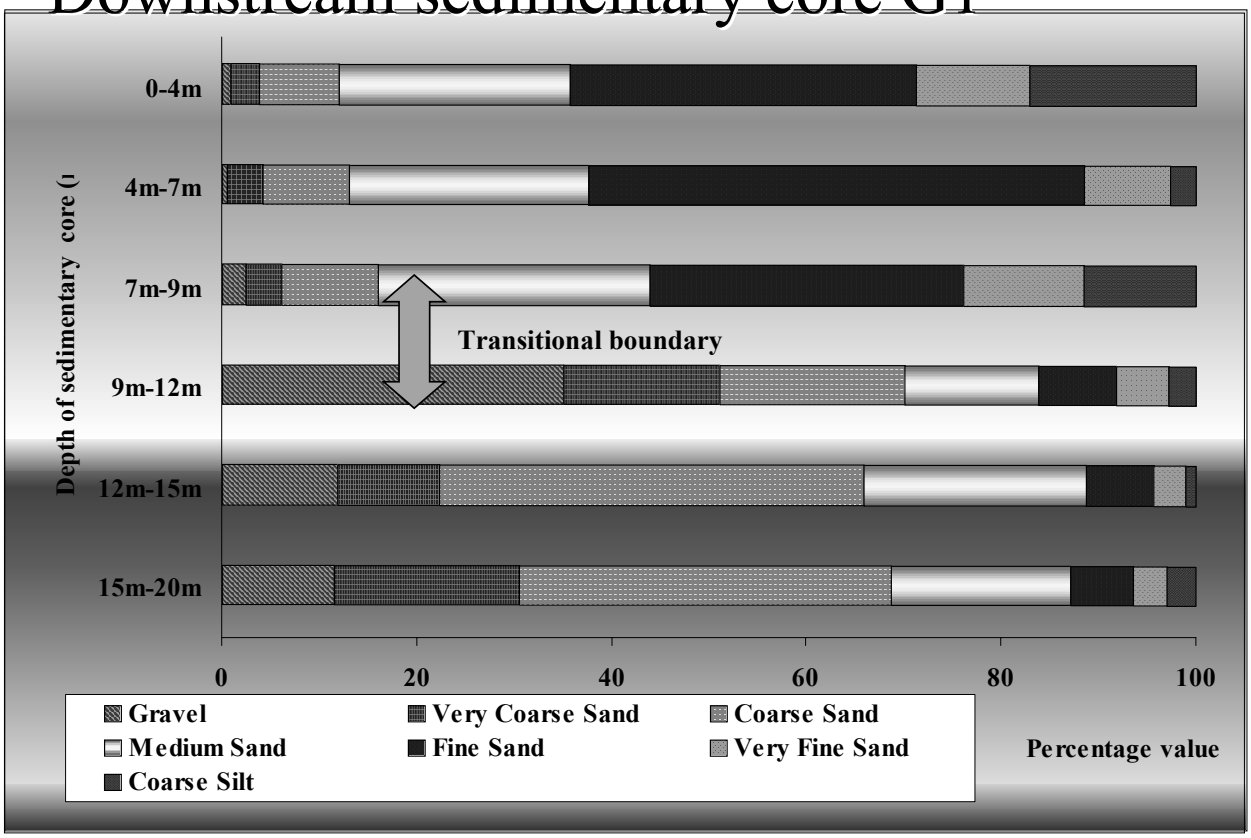


Textural terminology after *Folk* et al., 1970

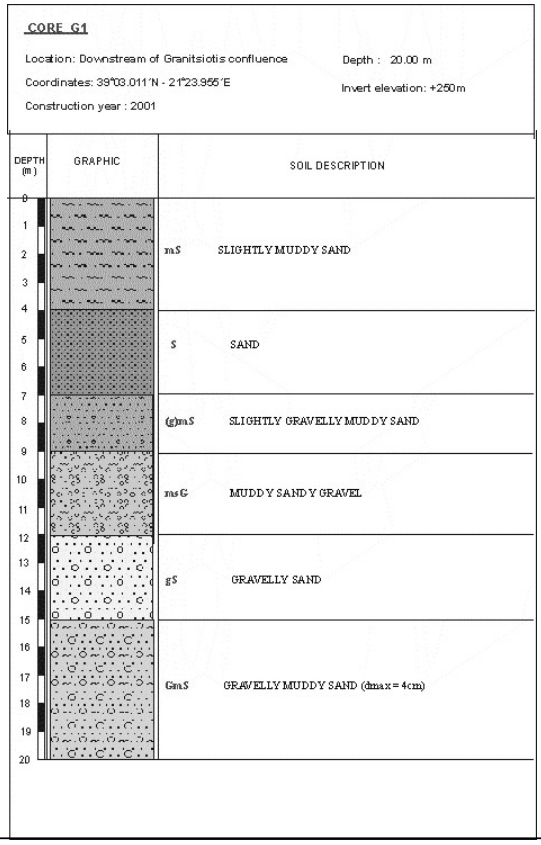
Downstream sedimentary core G1

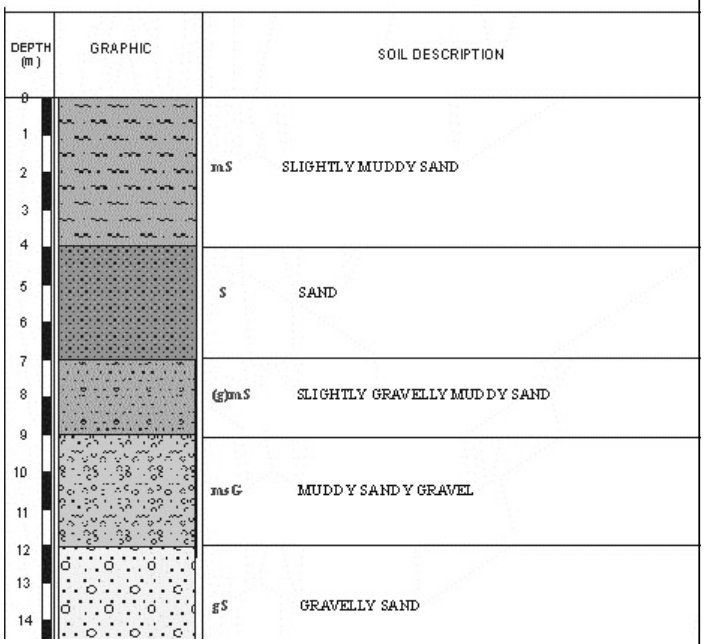


Downstream sedimentary core G1



Downstream sedimentary core G1





Textural terminology after *Folk* et al., 1970

Erosion process of deposited sediments

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Understanding the erosion mechanism

- **The recent reservoir drawdown is significant but far less from the maximum historical values**
- **The recent drawdown comes after seven consequent years with constantly high reservoir stages**
- **During the period of the last seven years, fine-grained fluvial sediments deposited forming the upper sedimentary layer**
- **Sedimentation continues after the hydrographic survey, as reservoir stages are still high, till the erosion eventually takes place**
- **At the maximum reservoir drawdown, the exposed sediment deposits were easily scoured, even from quite frequent river discharges**
- **It is possible, that a portion of the eroded sediments from core G2 transported downstream till the sedimentary core G1, which exhibits an increase of sediment depth since the hydrographic survey**

Reconstructing the sedimentation history of Kremasta reservoir

- **Well-sorted sediment strata reveal undisturbed depositional environment, stable hydraulic conditions or a unique source of sediment (e.g. high reservoir stages)**
- **On the contrary, poorly sorted sediment strata indicate unstable hydraulic conditions, e.g. river flow due to low reservoir stages and intense incoming floods and multiple sediment sources**
- **In both sedimentary cores, lower sediment strata exhibit a well-to-moderate sorting, possibly determining sedimentation rates during the first years of reservoir operation with high reservoir stages**
- **In particular, the prevailing of silt and very fine sands at the lower level of sediments at the core G2, reveal that the first depositional environment of high reservoir stages occurred between 1969 and 1972**

Reconstructing the sedimentation history of Kremasta reservoir

- **Middle sediment strata exhibit poorly - sorted stratification. The extremely frequent stage drawdowns do not support stable depositional environment**
- **The downstream sedimentary core exhibit less uniform sorting, mainly because of the influence of the tributary Granitsiotis River, which supplies sediment from a nearby watershed, additional to sediment transported from the upstream part of Acheloos River.**