

HYDROGEOPHYSICS

Characterisation and monitoring of aquifer systems
Interpolation of piezometric and log data
Description of the geological model
Estimation of physical param. influenced by water

SEDIMENTARY AQUIFER

1D TIMELAPSE

Coll. : Mines ParisTech
Pasquet et al., 2015 (JAG)

Orgeval experimental basin

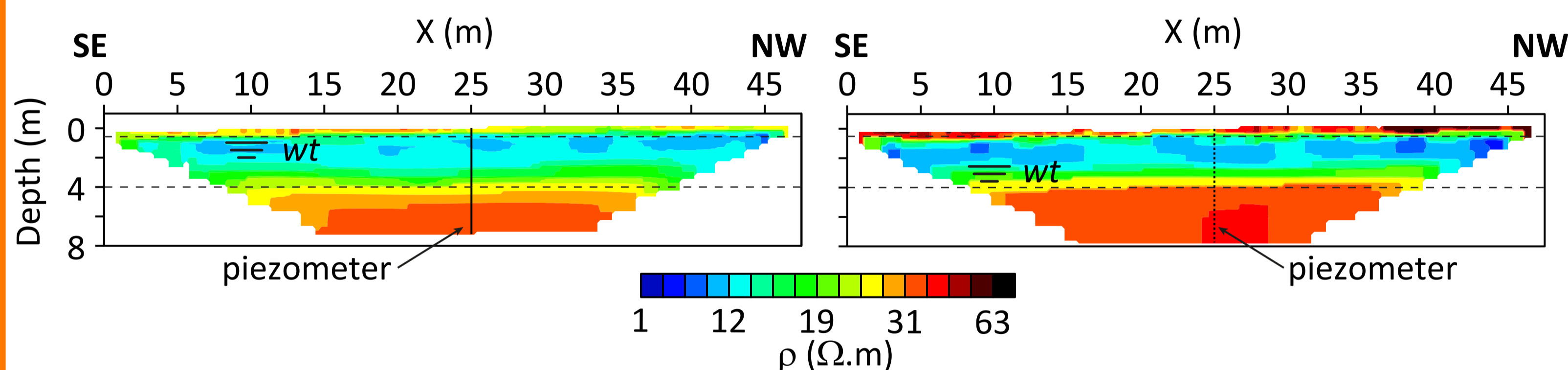
Multi-layer aquifer system
Dense network of piezometer
Plateau area with tabular layers
Two distinct hydrological conditions

Mouhri et al., 2013 (J. of Hydrol.)

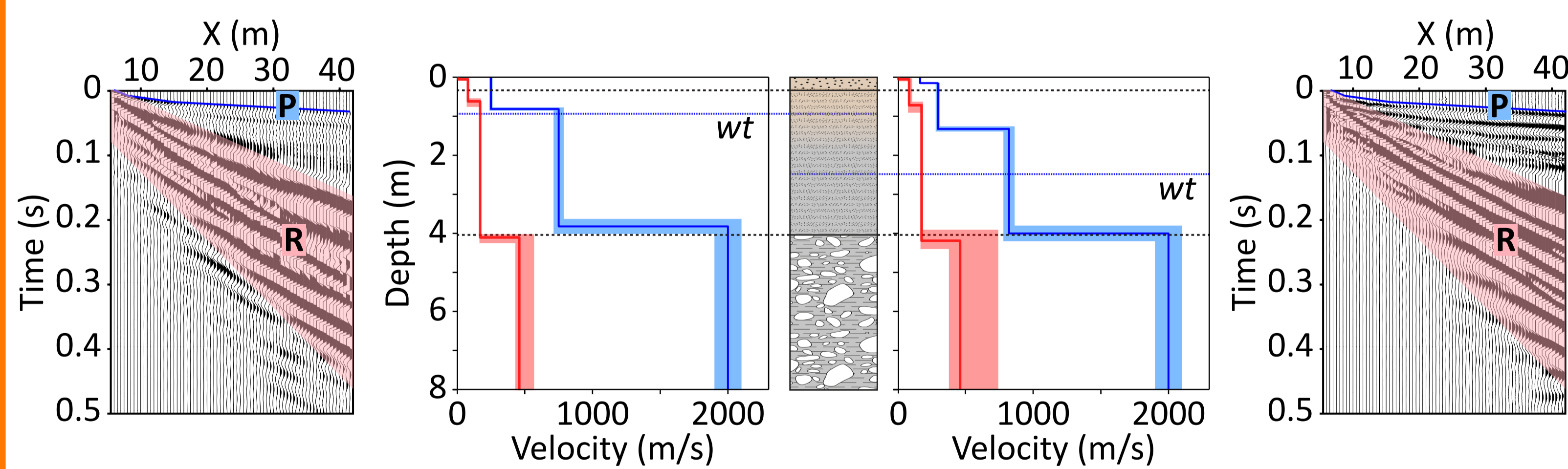
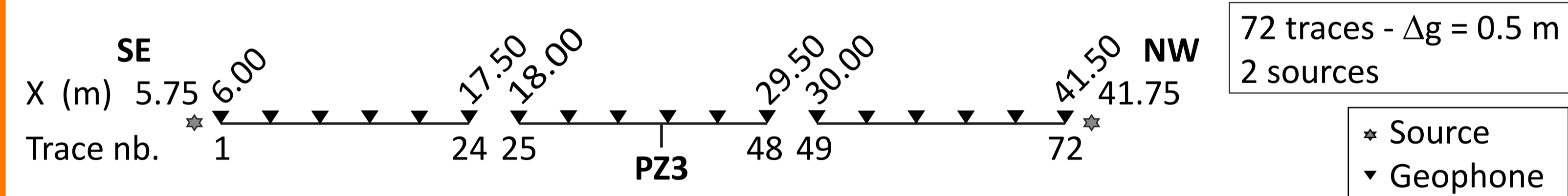
High water (March)



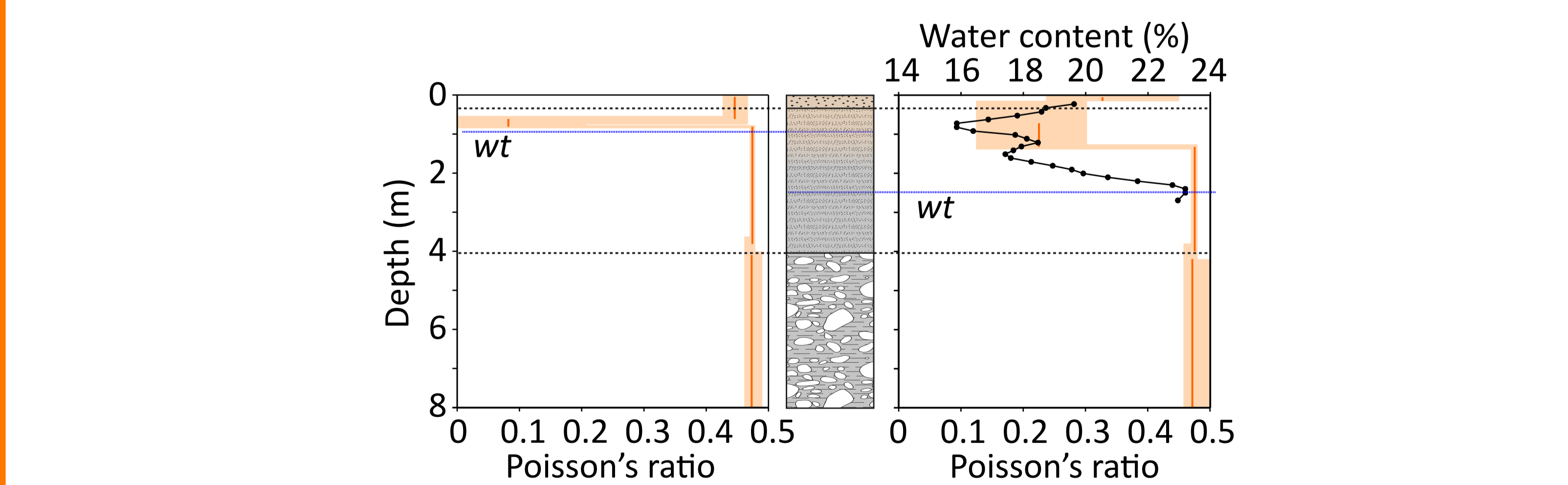
Low water (August)



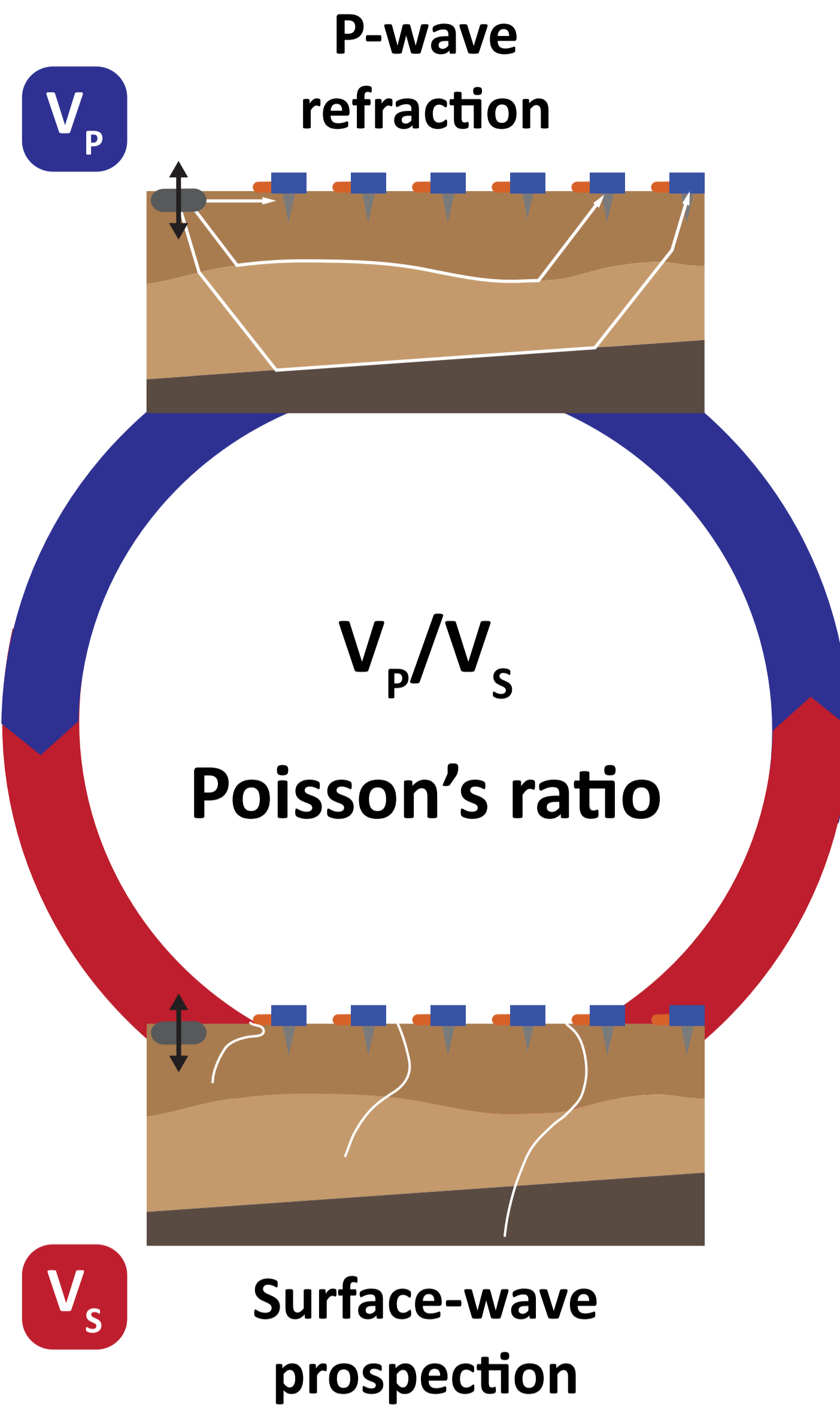
Electrical resistivity tomography: 1D medium (soil / loess / limestone)



Seismic data interpretation: $V_p \Rightarrow$ litho. limits + supplementary interface
 $V_s \Rightarrow$ litho. limits / no influence of water table



V_p/V_s and Poisson's ratio: Water table detection at high water
Low water \Rightarrow progressive increase of water content



SEISMIC METHODS WITHIN CRITEX

Joint P- and surface-wave acquisition
 $V_p \Rightarrow$ P-wave first arrival interpretation
 $V_s \Rightarrow$ surface-wave dispersion inversion
 V_p and V_s strongly decoupled with fluids $\Rightarrow V_p/V_s$

FRACTURED AQUIFER

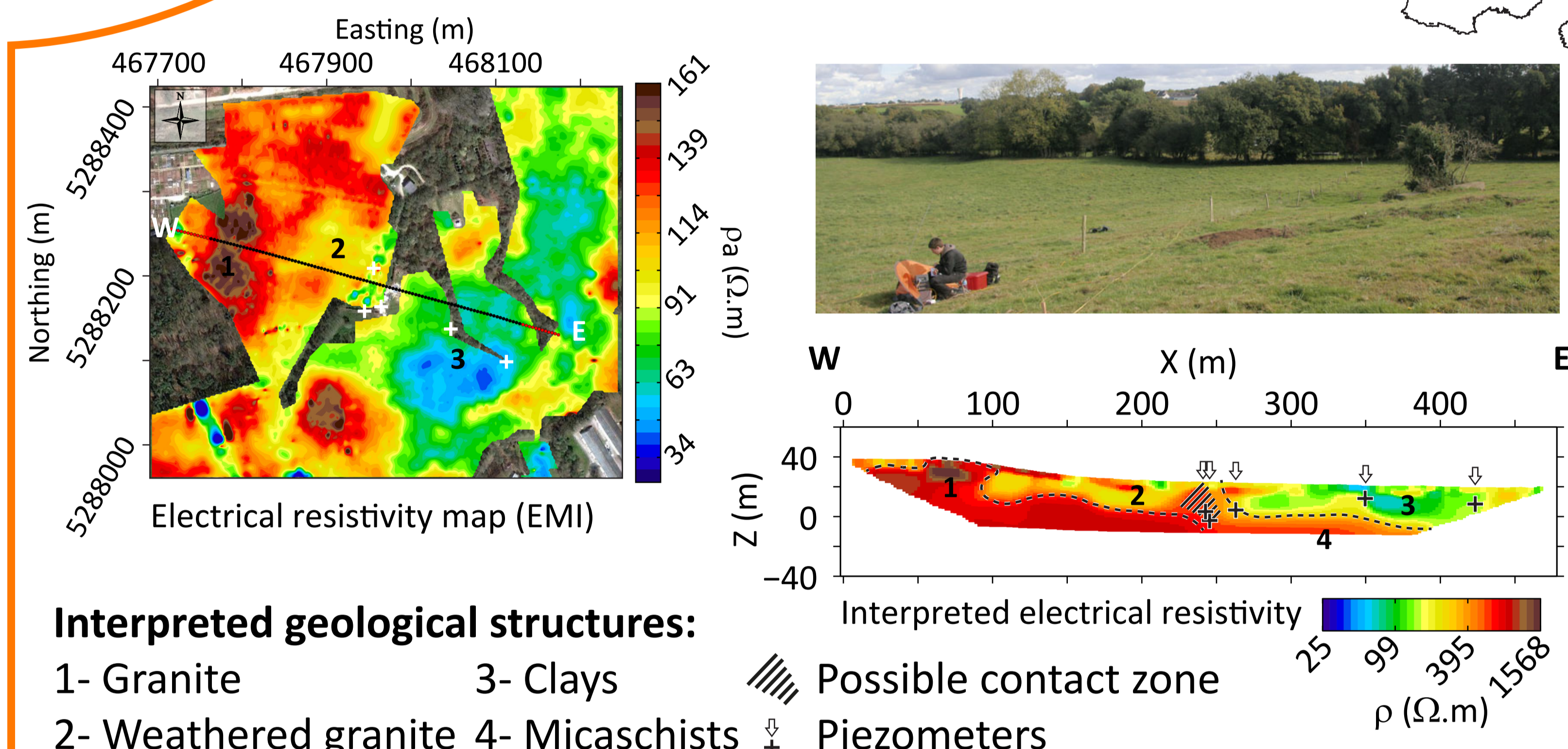
2D LATERAL VARIATIONS

Coll. : Géosciences Rennes
Pasquet et al., accepted (NSG)

Ploemeur hydrological observatory

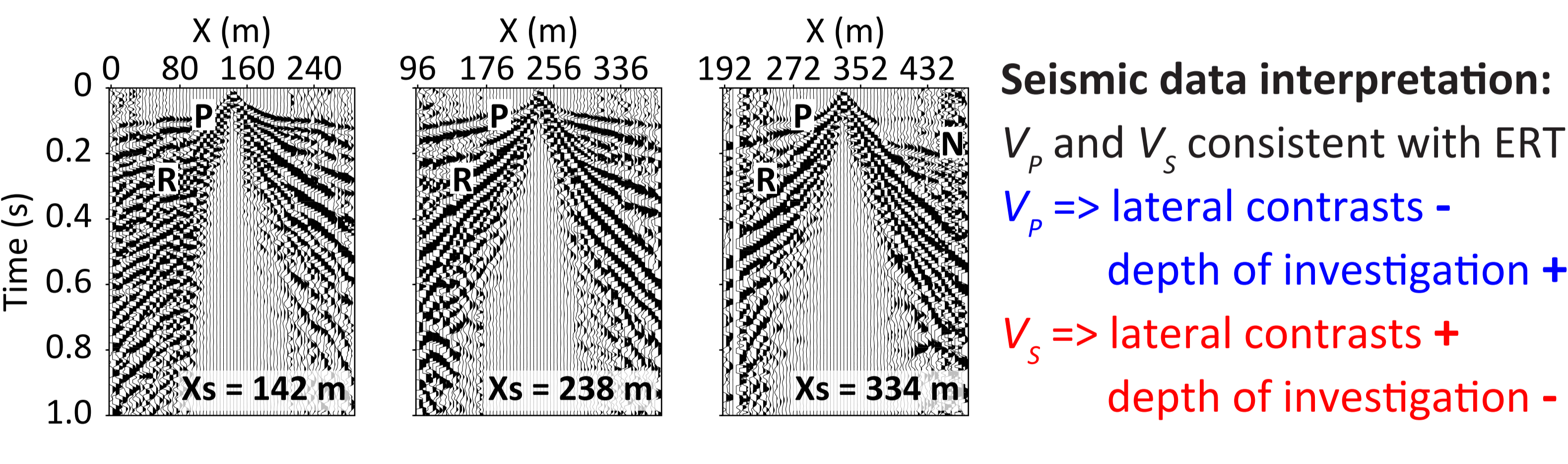
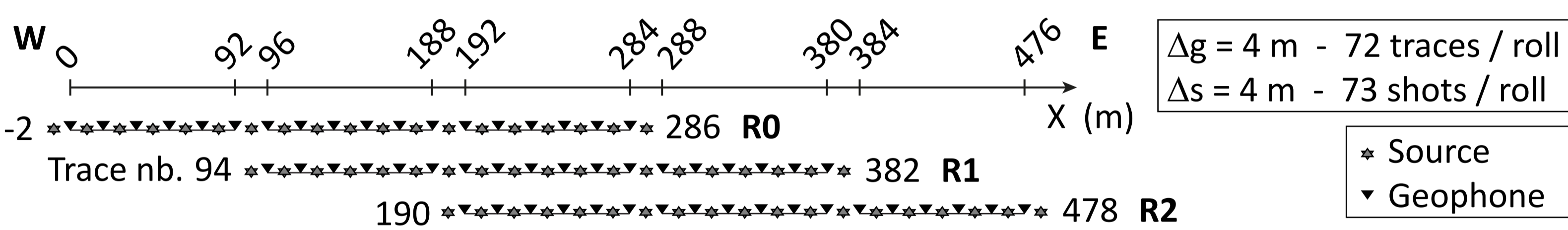
Productive fractured aquifer
Granite-micaschists contact and fault
Dense network of piezometric wells
Low permeability and porosity lithologies

Ruelleu et al., 2010 (JAG)



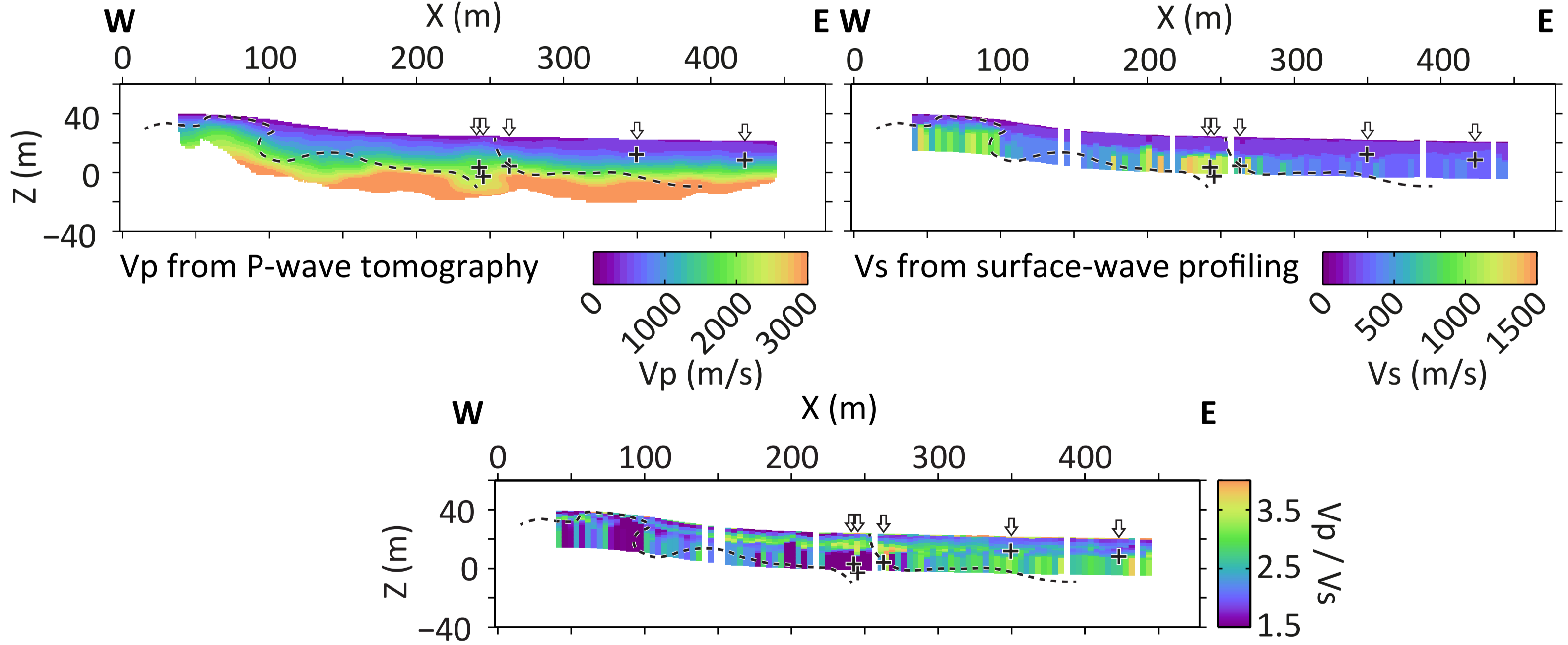
Interpreted geological structures:

- 1- Granite
- 2- Weathered granite
- 3- Clays
- 4- Micaschists
- Possible contact zone
- Piezometers



Seismic data interpretation:

V_p and V_s consistent with ERT
 $V_p \Rightarrow$ lateral contrasts - depth of investigation +
 $V_s \Rightarrow$ lateral contrasts + depth of investigation -



V_p/V_s and Poisson's ratio: Strong lateral contrasts consistent with ERT
Water table detection in the eastern part (clays)

CONCLUSIONS

Seismic methods have been proposed for the geophysical characterisation of aquifer systems. A specific methodology has been developed for the combined exploitation of P- and surface waves present on seismic records. The use of this methodology in two distinct hydrogeological contexts allowed for estimating V_p/V_s ratio lateral and temporal variations consistent with a priori geological information and existing geophysical and piezometric data.

References