

## MONASTERY OF MAULBRONN

World Cultural Heritage since 1993

### Engineering geological conditions and problems:

#### Geology (thickness of subsoil layers)

- 0.8 - 3.7 m silt, stony, hard at top, soft underneath (filling)
- 1.5 - 8.0 m silt, stony, soft, with intercalations of peat and freshwater calcareous mud, at base solidified solifluction layers
- 16.0 - 20.0 m clay stone and clay-marlstone (Gipskeuper Formation), friable, with leaching residues of gypsum, turned into silt by deconsolidation
- base clay stone with gypsum layers, hard

#### Ground water

Along the valley ground water level fluctuates between 0.5 and 2.8 m below surface. The water is weakly concrete-attacking (sulfate concentration 545 mg/l). Within the hard rock (Gipskeuper) ground water levels fluctuate between 0.2 and 2.4 m below surface with seasonal variations of 0.3 - 1.1 m. This ground water is artesian with its hydraulic level partially reaching higher than along the valley ground. It is strongly concrete-attacking with sulfate concentrations of about 1150 mg/l.

#### Settlement-related damages to buildings

Some exterior walls have shifted a few centimetres due to long term settlements. Some vertical mortar joints have appeared, which, however, show no signs of further opening.

As a countermeasure several foundations were widened or underpinned in 1934. During the last years constructive measures have been carried out (installation of tieback anchors, load relocations). As an interim solution overloaded pillars were provided with provisional wooden casings.

#### Damages to building as a result of moisture penetration

Humidity spots, algal mats and efflorescence of gypsum and epsomite appeared due to capillary rise of ground moisture inside the sandstone masonry and condensation at the inner walls. Crystallization pressure caused deconsolidation of wall plaster and defoliation of wall paintings.

Attempts are being made to reduce wall humidity by controlled ventilation. Room humidity is measured by sensors and automatically transmitted via a gaging station to a computer controlling an aerator.



*Maulbronn Monastery Complex*

### Other information:

The former Cistercian Abbey is not just the most completely preserved monastery complex north of the Alps, but also a perfect example of medieval architecture.

Construction work began in 1147 and the Church, a Romanesque basilica with three naves, was consecrated to Mary, Mother of God, in 1178. The men's chancel features ornately decorated oak stalls.

The monastery courtyard is still ringed by the fortified wall and the towers, domestic buildings and living quarters built, within, on and above the walls.

### References on studies already performed:

Source: Landesamt für Geologie und Bergbau Baden-Württemberg.