



2.8 Natural building materials by heat effect


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Natural building materials by heat effect


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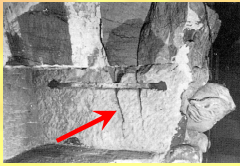
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Scientific Department for Fire Protection
H-1113 Budapest Diószei út 37. - <http://www.emi.hu>

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Traces of Former Fires




Colour change



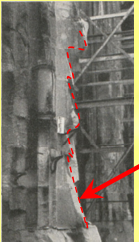
Cracking



Spalling



Rounding of edges



Breaking

2

Burnt adobe




Becilla de Valderaduey, Valladolid, Spain rural construction

3

Investigated stone types

Sandstones

- Balatonrendes* (V) – reddish, fine grain, ferruginous-clayey, Permian
- Ezüsthegy* (E) – white, fine grain, kaolinitic, Oligocene
- Rezi* (R) – greenish, medium grain, jarositic, Pannonian
- Cottaer* (C) – greyish, fine grain, kaolinitic-illitic, Cretaceous
- Donzdorfer* (Dd) – ochre, fine grain, ferruginous clayey, Jurassic
- Maulbronner* (M) – reddish grey, fine grain, clayey, Triassic
- Pfinztaler* (Pf) – greyish red, medium grain, chlorite, Triassic
- Pliezhausener* (Pli) – yellowish white, medium grain, dolomitic, Triassic
- Postaer* (Po) – off-white, medium grain, siliceous, Cretaceous
- Rohrschacher* (B) – grey, fine grain, calcareous, Miocene Molasse

Limestones

- Tardos compact* (T) – red, pelagic, microbioclastic wackestone, Jurassic
- Süttő travertine* (F) – creamy, bioclastic wackestone to peloidal oncoidal packstone
- Sóskút oolitic* (D) – coarse grain, Miocene



Rhyolite tuff

- Egertihámér* (Rt) – grey white, Miocene

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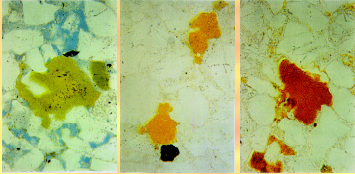
Investigation methods

- Test conditions, heating in oven 6 hours 6 temperature (150, 300, 450, 600, 750, 900°C)
- Makroskopical investigation
- Petrological analyses
 - Thin sections analyses with Polarising microscope
 - X-ray Powder Diffraction (XRD)
 - Differential Thermal Analyses (DTA)
 - Scanning Electron Microscope (SEM)
- Petrophysical test
 - Mass properties (specific and bulk density, porosity, water adsorption)
 - Ultrasonic sound velocity, Durosokop
 - Uniaxial compressive strength test
 - Indirect tensile strength test
 - Colour measuring (CIELAB)

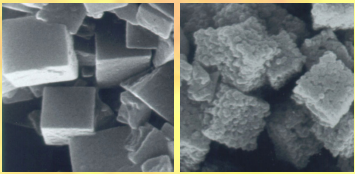



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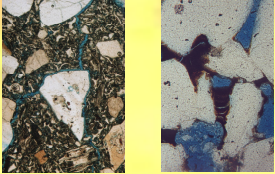
Mineralogical changes



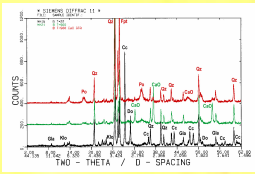
Glauconite in Cottaer sandstone (Thin section)
22°C 450°C 900°C



Jarosite in Rezi sandstone (SEM)
22°C 900°C



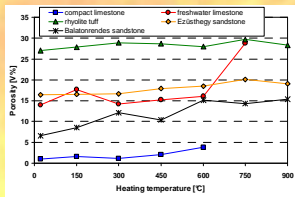
Egertihámér rhyolite 900°C
Postaer sandstone 450°C



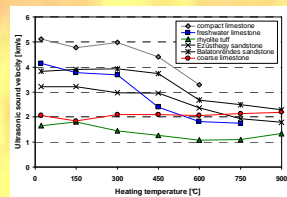
Rohrschacher sandstone (XRD)
red - 22°C green - 900°C black - later

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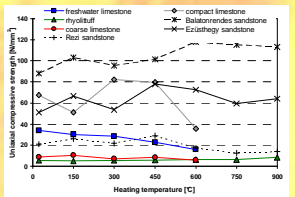
Petrophysical changes (natural stone)



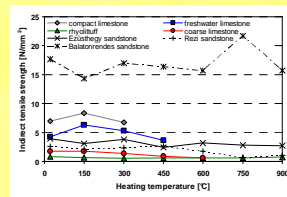
Porosity



Ultrasonic sound velocity



Uniaxial compressive strength



Indirect tensile strength

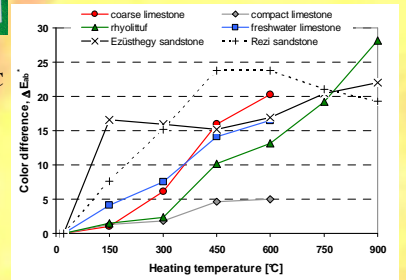
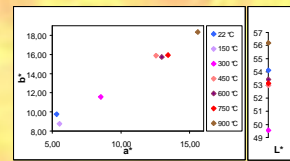
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Colour measuring (natural stone)



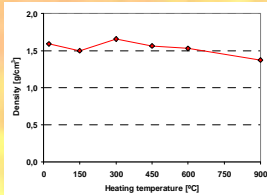
Sóskút coarse limestone

22°C → 900°C

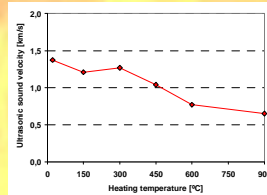


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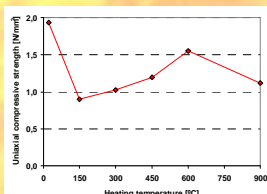
Petrophysical changes (adobe)



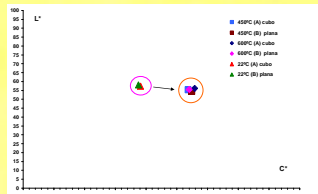
Density



Ultrasonic sound velocity



Uniaxial compressive strength



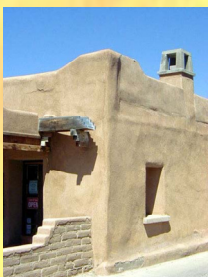
Colour

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Conclusion

- ◆ At the effect of heat changes take place in the inner structure and mineral composition, which influences the petrophysical parameters
- ◆ The heat resistance depends on:
 - the type of cementing mineral
 - the amount of the cement (grain/cement ratio)
 - the grain size (fine, medium, coarse)
 - the grain to grain or matrix to grain contacts
 - the amount of organic matter (e.g. straw by adobe)
- ◆ The compact stones show more dramatic change in porosity at elevated temperature
- ◆ The porous and cement rich stone is more adaptable, these can adopt the addition strength caused by thermal expansion
- ◆ The silica cemented, ferruginous or clayey stones are less sensitive than the carbonatic ones (disintegration at higher temperature)

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Thank you for your attention!

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