

Penza State University of Architecture and Construction

Penza, Russia

**Geopolymer binders
based on magmatic rocks**

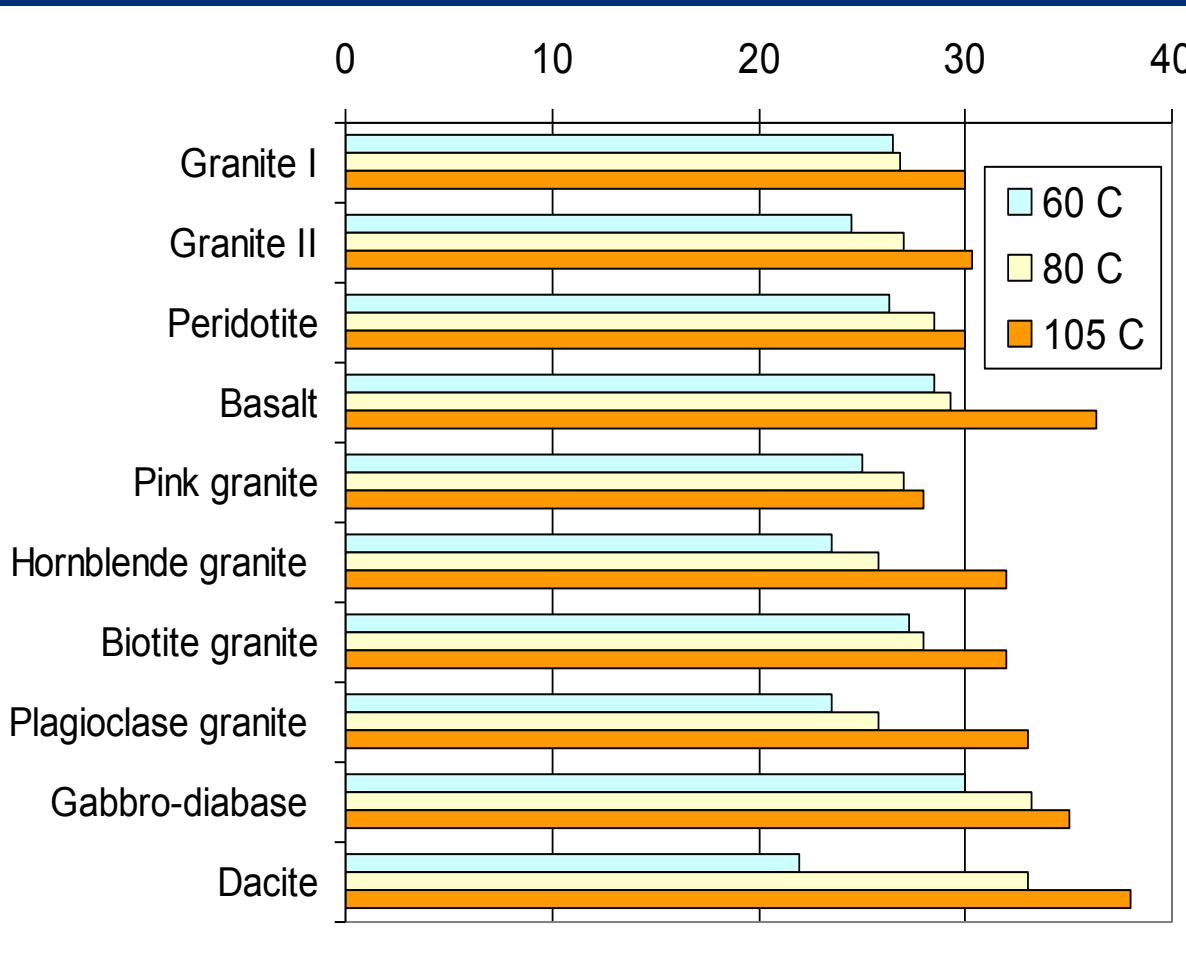
Nadezda Eroshkina

senior researcher, candidat of technical sciences

Binders based on magmatic rocks:

- In the course of production and processing of aluminosilicate magmatic rocks, particularly to obtain the coarse aggregate for concrete, large amounts of disperse waste are produced.
- We examined these waste (basalt, gabbro-diabase, peridotit and granite) as raw materials.
- Activator of curing - sodium waterglass +NaOH for $M_s=1,1-1,3$
- Thermal treatment at a temperature of 60 to 105 °C - during 10 hours
- In normal conditions (without thermal treatment) – 3 and 28 days

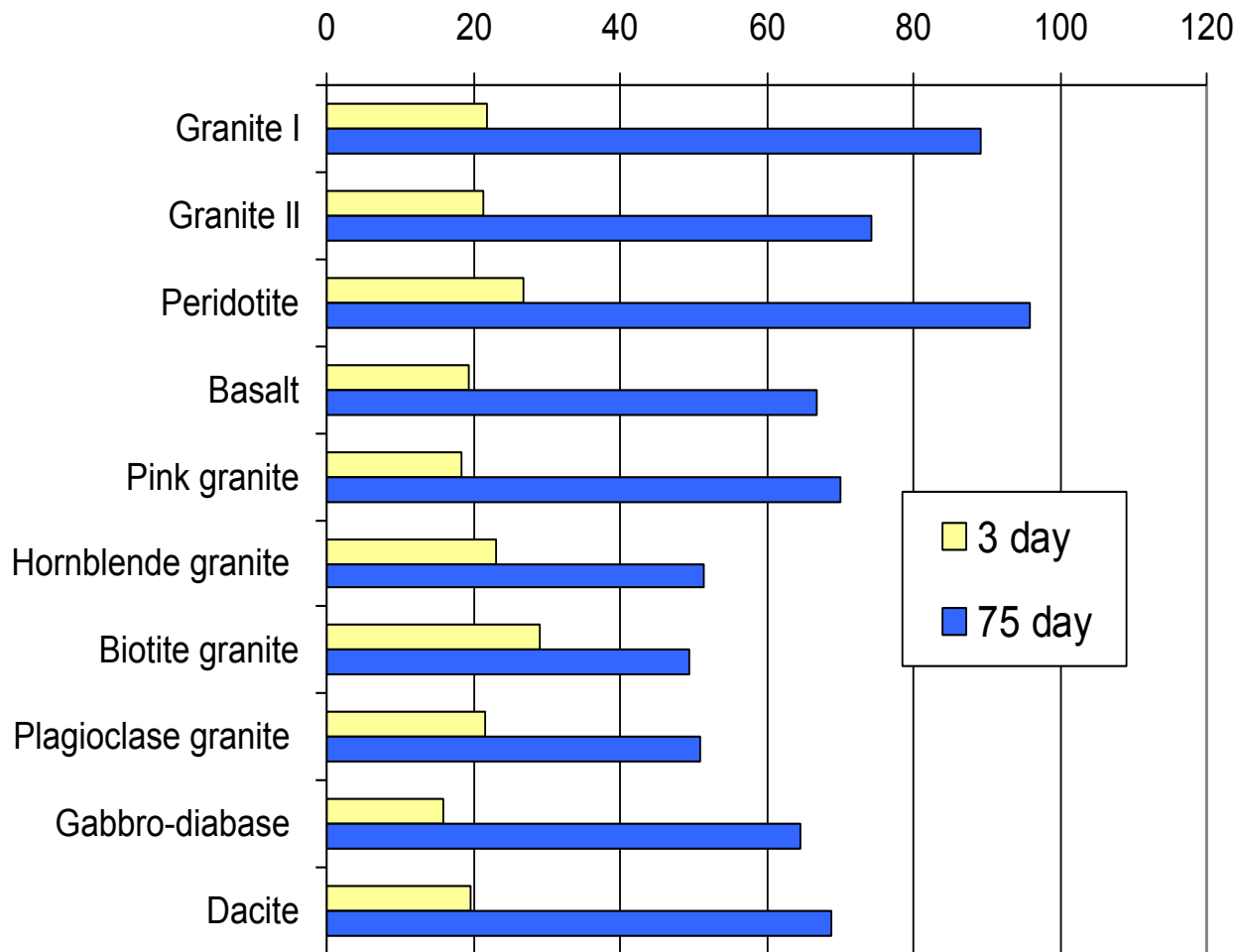
The compressive strength of binders based on magmatic rocks without the slag after the thermal treatment, MPa



Strength of binder in thermal treatment at a temperature of 60 to 105 °C - 22-37 MPa.

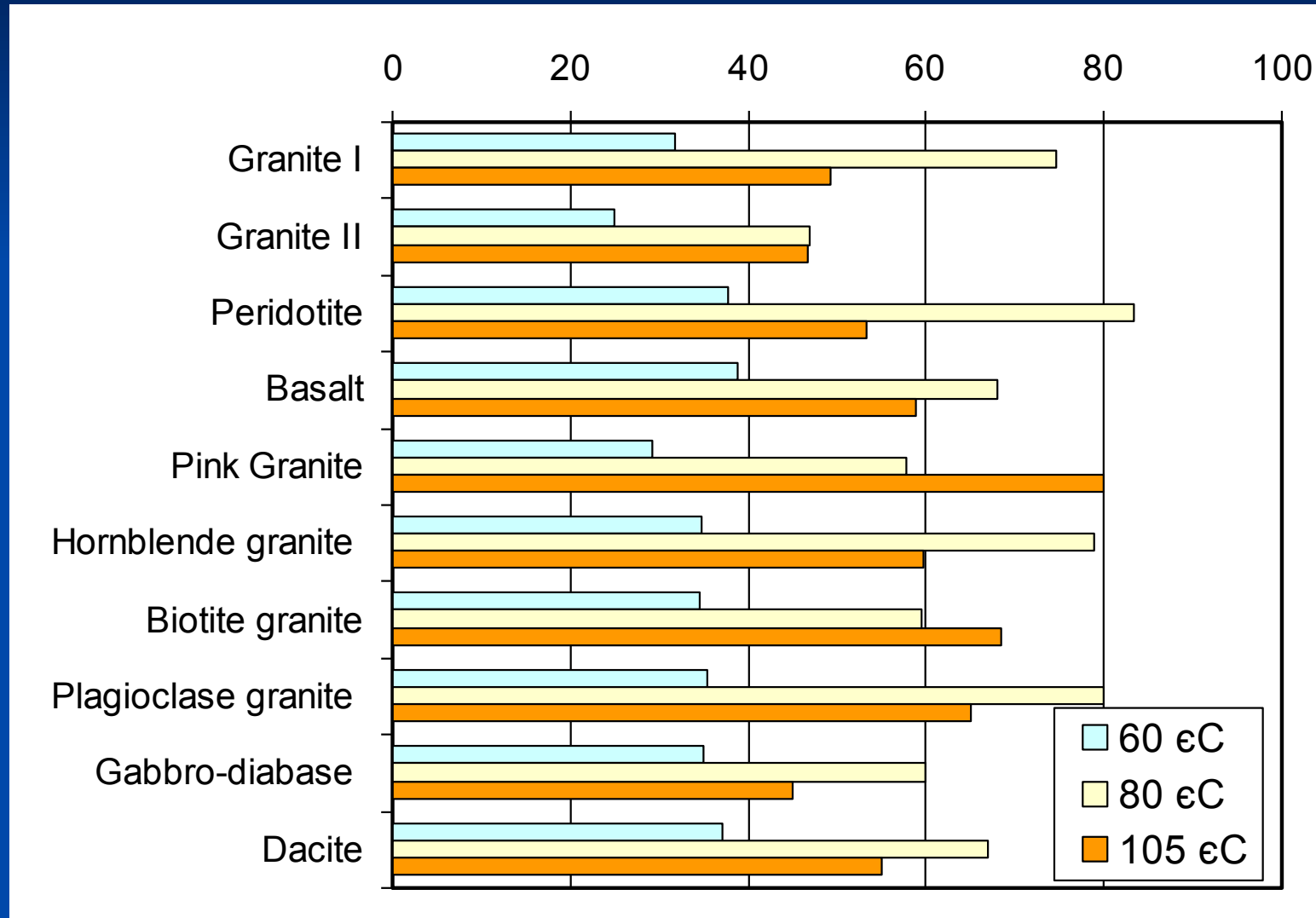
These binders are not water resistant – at long water saturation their strength decreases by 65-85%.

The compressive strength of binders based on the magmatic rock with the addition of 25 % slag hardening in normal conditions, MPa

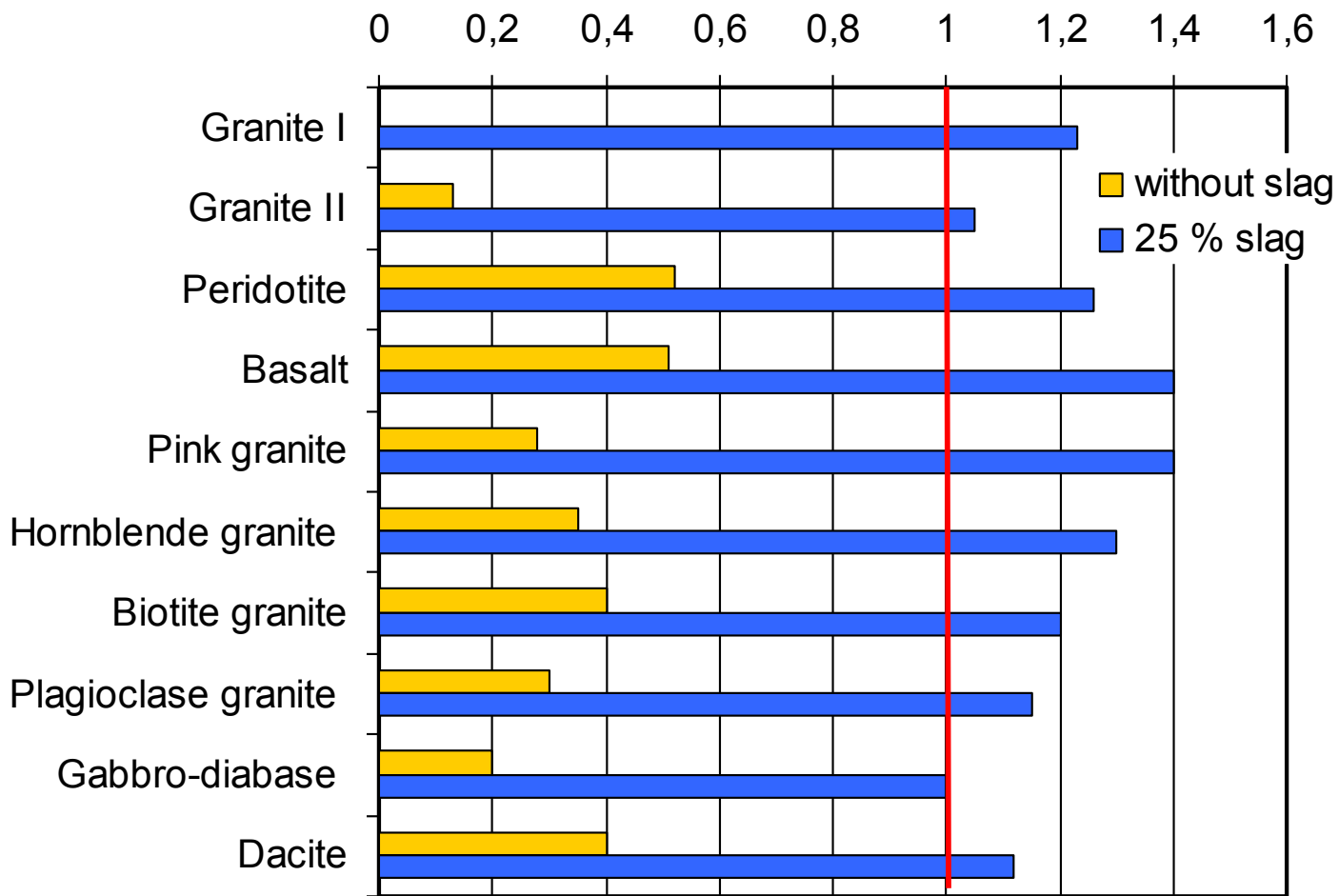


If 25% of the rock are replaced by blast furnace granulated slag, the binder hardens both in normal conditions and under thermal treatment

The compressive strength of binders based on the magmatic rock with the addition of 25 % slag after the thermal treatment, MPa



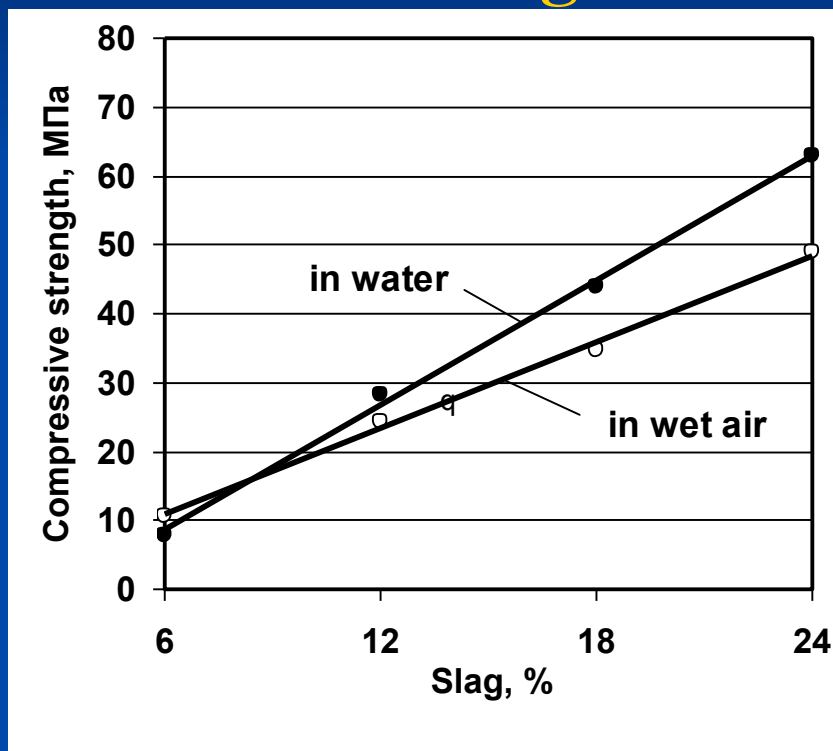
Coefficient of water resistance of binders



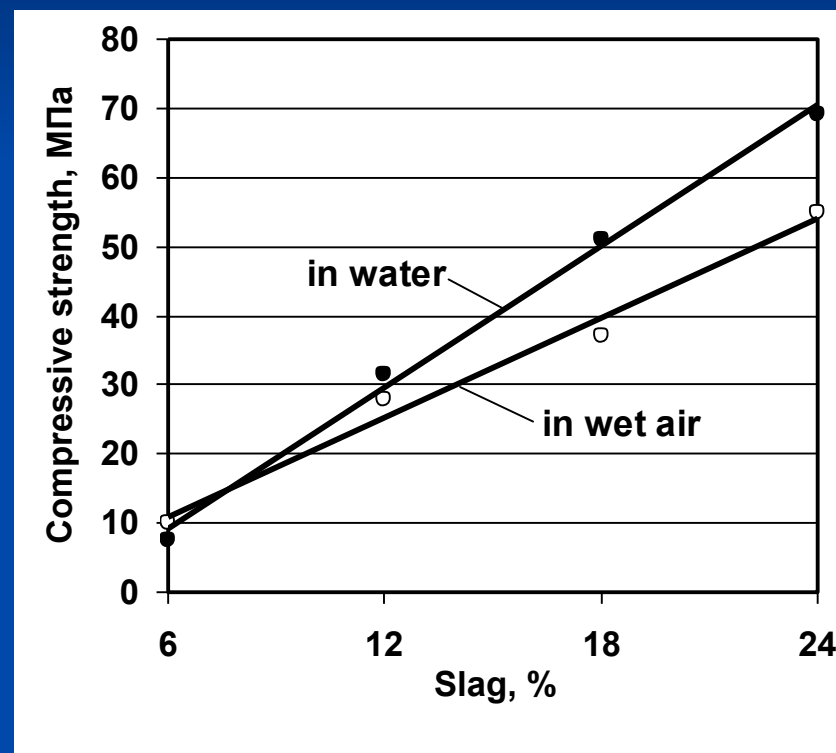
The addition of slag to composition binder - increase of water resistance.

Influence of slag proportion on strength of binders in different conditions hardening

binder based on granite



binder based on basalt

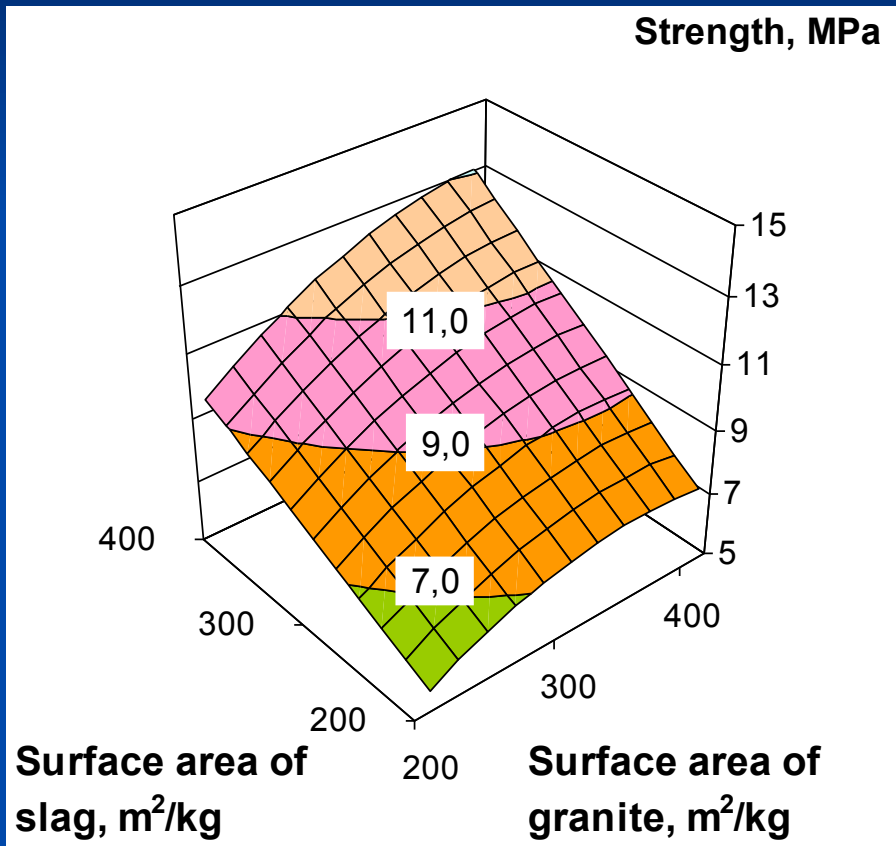


Addition of slag into the composition of binder showed that binders become water resistant at a rate of slag not less than 6 - 8%

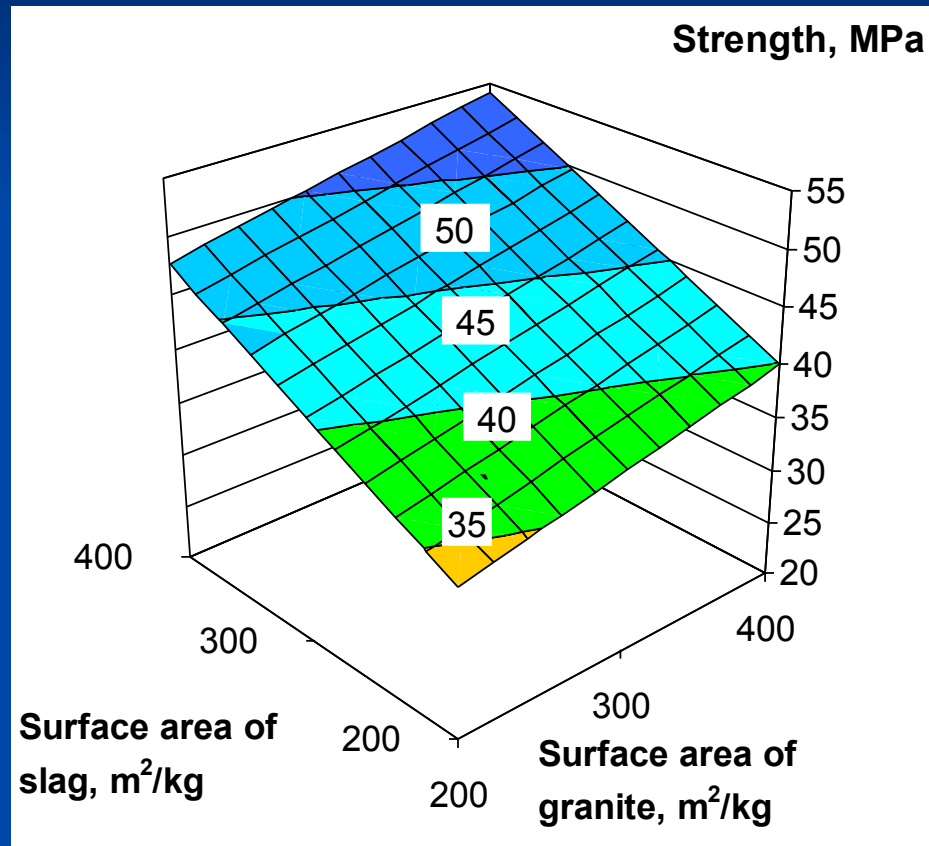
- An important question that we are not able yet to answer definitely – whether magmatic rocks are in a greater degree an active component of the binder or a filler that reduces shrinkage in the matrix of reaction products of slag and liquid glass.

Influence of dispersion of components of binder on strength in normal conditions

3 day

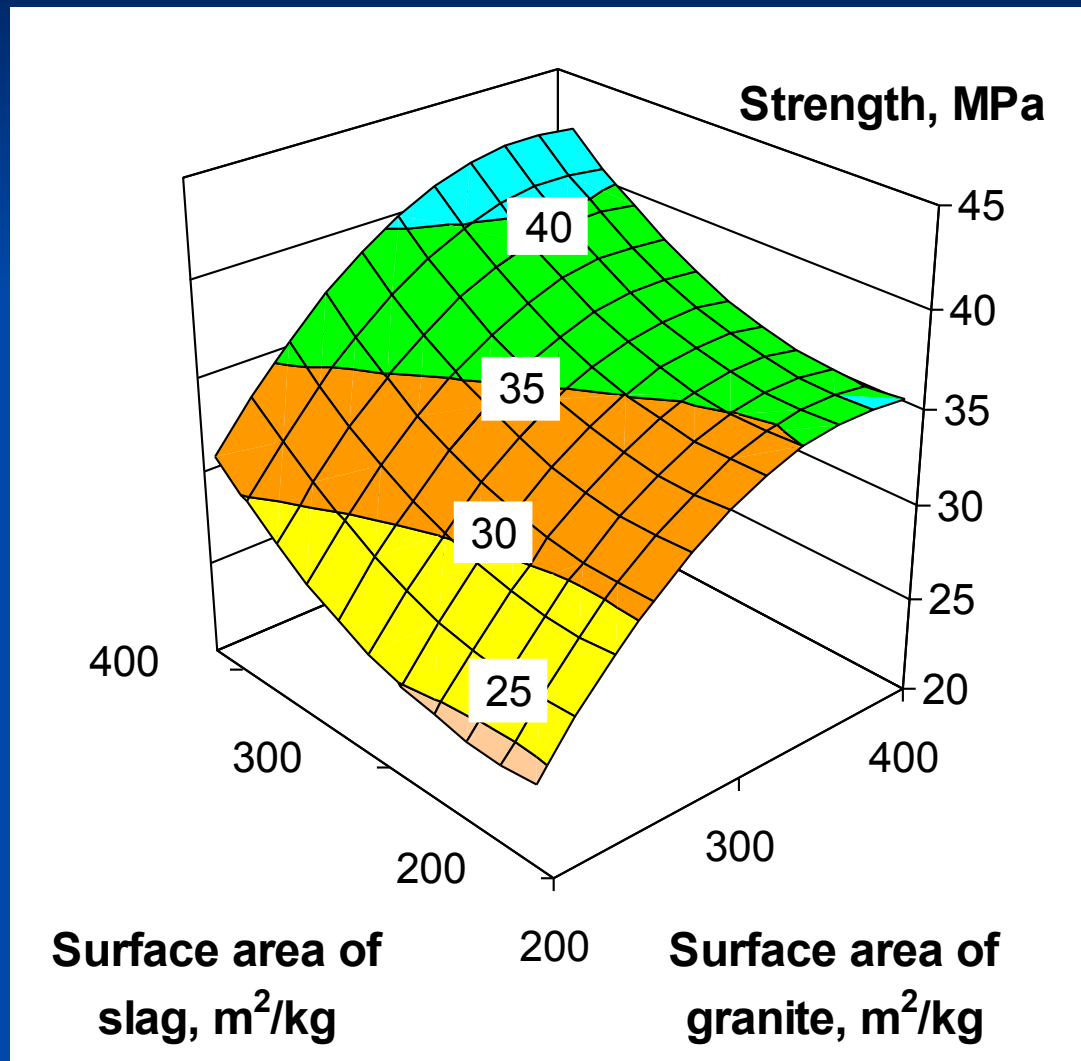


28 day



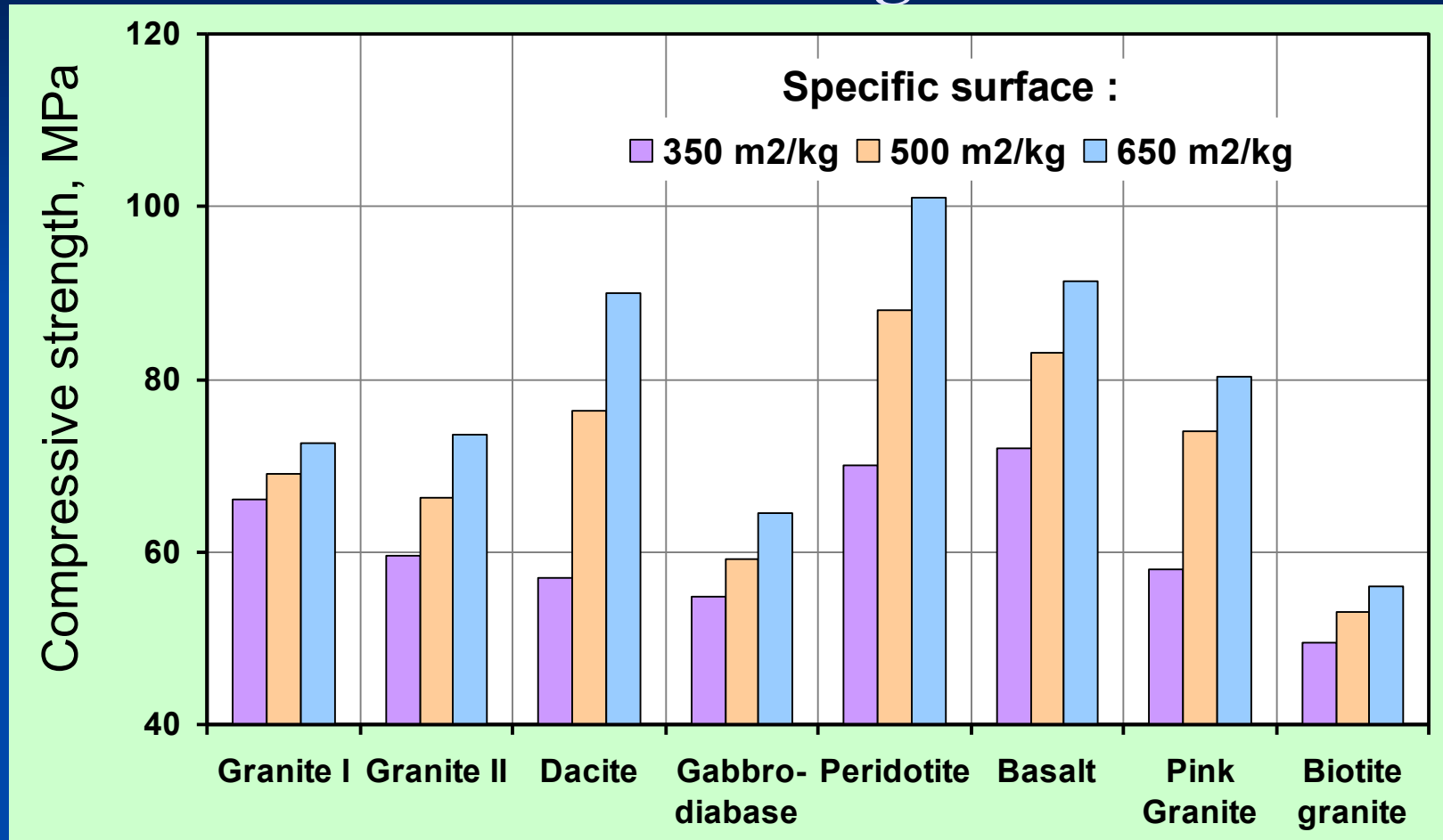
- The results of examination of influence of grinding fineness of the rock and slag on strength of the binder testify in favor of the first hypothesis.
- Increasing of the surface area of the rock to a much lesser extent than increasing of dispersion of slag, enlarges the strength of the binder, particularly in the early stages of curing. However, later and at temperature increase during thermal treatment, the influence of dispersion of the rock on strength increases.

Influence of dispersion of components of binder on strength after the thermal treatment (80°C)



- This shows that the rock is an active component of the binder, but with slow reaction speed.
- The influence of the grinding fineness for the studied rocks is considerably different, that also means that they are an active component.

Compressive strength of binders depending on the fineness of the magmatic rocks



It is possible to produce a water resistant binder with strength of 40-100 MPa

Thank you for attention