Study

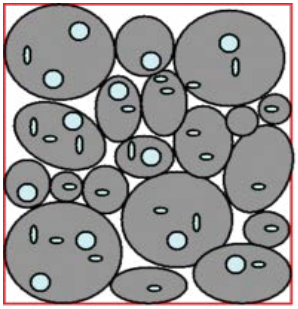
Study On the porosity of our materials

Achieved in 2022 by the CALNESIS laboratory on terracotta, stoneware and technical ceramic samples

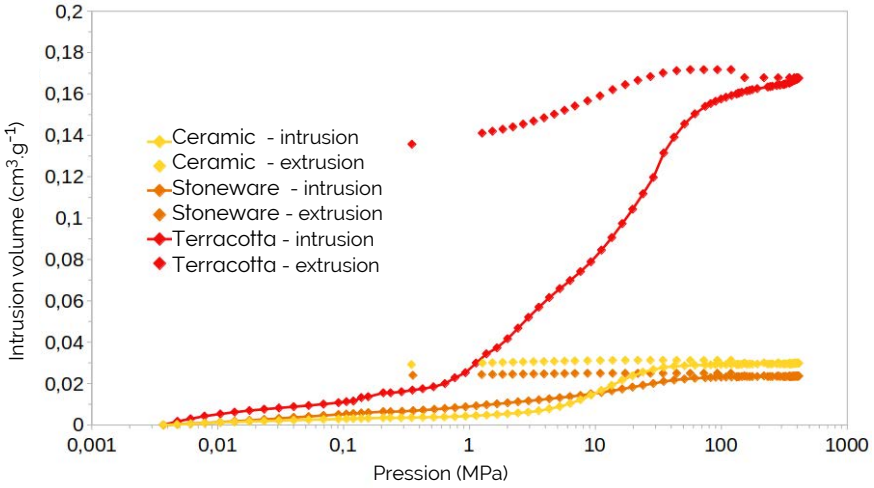
CALNESIS uses mercury, the only dense and remarkably mobile liquid metal with a non-wetting character, to introduce it into the selected material with a pressure ranging from 0.001 Mpa to 413 Mpa. (reminder: 0.1013 Mpa = average atmospheric pressure, 0.1 Mpa = 1 bar)

With mercury and such pressure, pore volume, porosity and pore size distribution can be well measured.

These intrusion volumes make it possible to define a total porosity of the material and approximately a porosity attainable by a liquid with its pressure in a neutral medium without other influencing parameters (temperature, humidity, fermentation gases, etc.)



Example and diagram of the porosity of a material



Mercury intrusion and extrusion curves for samples analysed in this study

TABLE SUMMARISING THE DATA COLLECTED BY THE LABORATORY :

500 l 3 jars	**Ceramic**	**Stoneware**	**Terracotta**
Total porosity (A)	6,70%	5,60%	31,80%
Jar weight (B)	180 kgs	200 kgs	170 kgs
Density (pbulk g/cm3 at 0.004Mpa) (C)	2,24	2,37	1,89
Volume of jar material (B/C = D)	80,4 l	84,4 l	89,9 l
Total pore volume (air) (DxA =E)	5,39 l	4,73 l	28,59 l
Maximum volume of oxygen for 500l (oxygen/ air Tx =21%) (E x 21% = F)	1,13 l	1 l	6 l
Oxygen mass (1.354) for 500 l * (F x 1.354 = G)	1500 mg	1400 mg	8100 mg
Oxygen rate per litre (G / 500 l)	3 mg / l	2,8 mg l	16 mg / l

**density of oxygen at a temperature of 15°*

Terracotta contains potentially 5 times more oxygen than stoneware or technical ceramics.

Thanks to this high porosity, the terracotta jar allows more micro-oxygenation than stoneware or technical ceramics. However, not all of this porosity is achievable and the maximum solubility of oxygen in wine or water at a temperature of 15° is 10mg/ litre (winkler table).

What is surprising for an uninformed winemaker is the speed of dissolution of this available oxygen in the terracotta.

You will see in the following study how this oxygen is dissolved over time (7 months ageing).