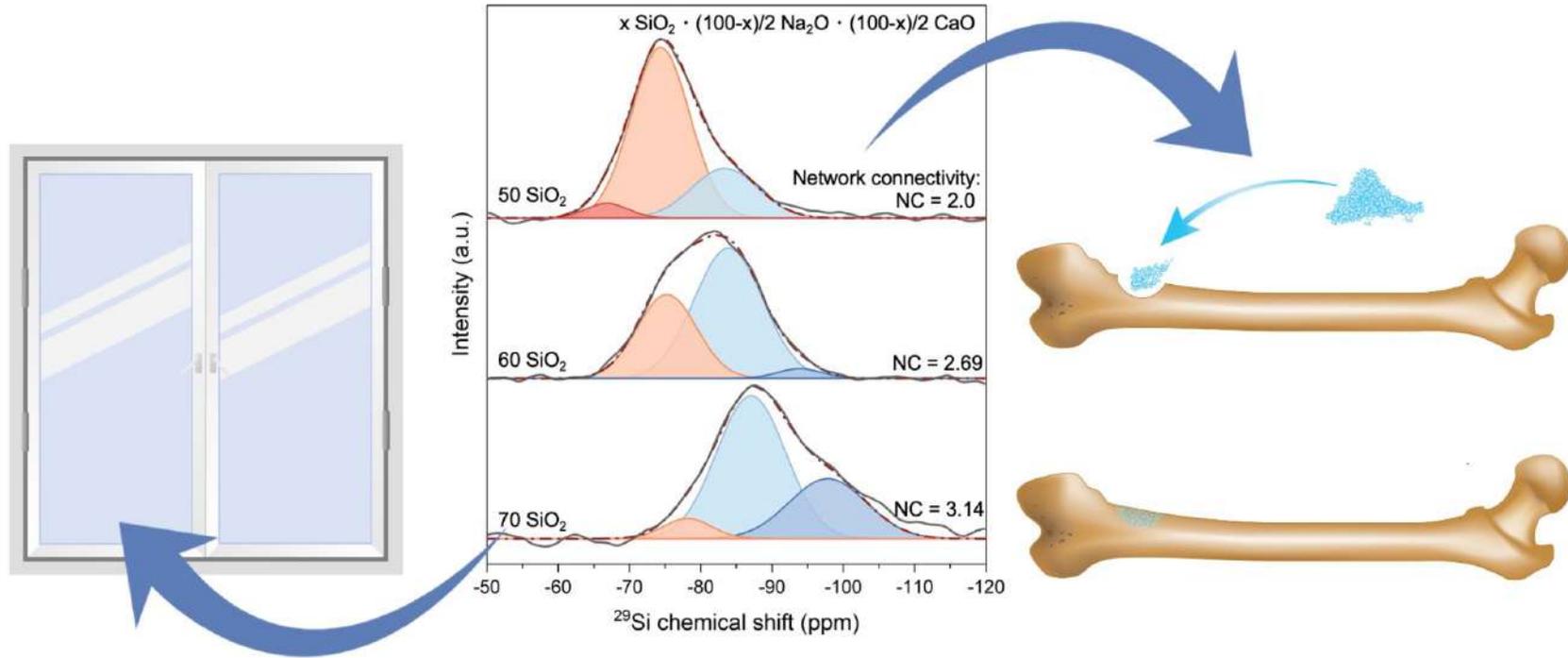


Les bioverres ?



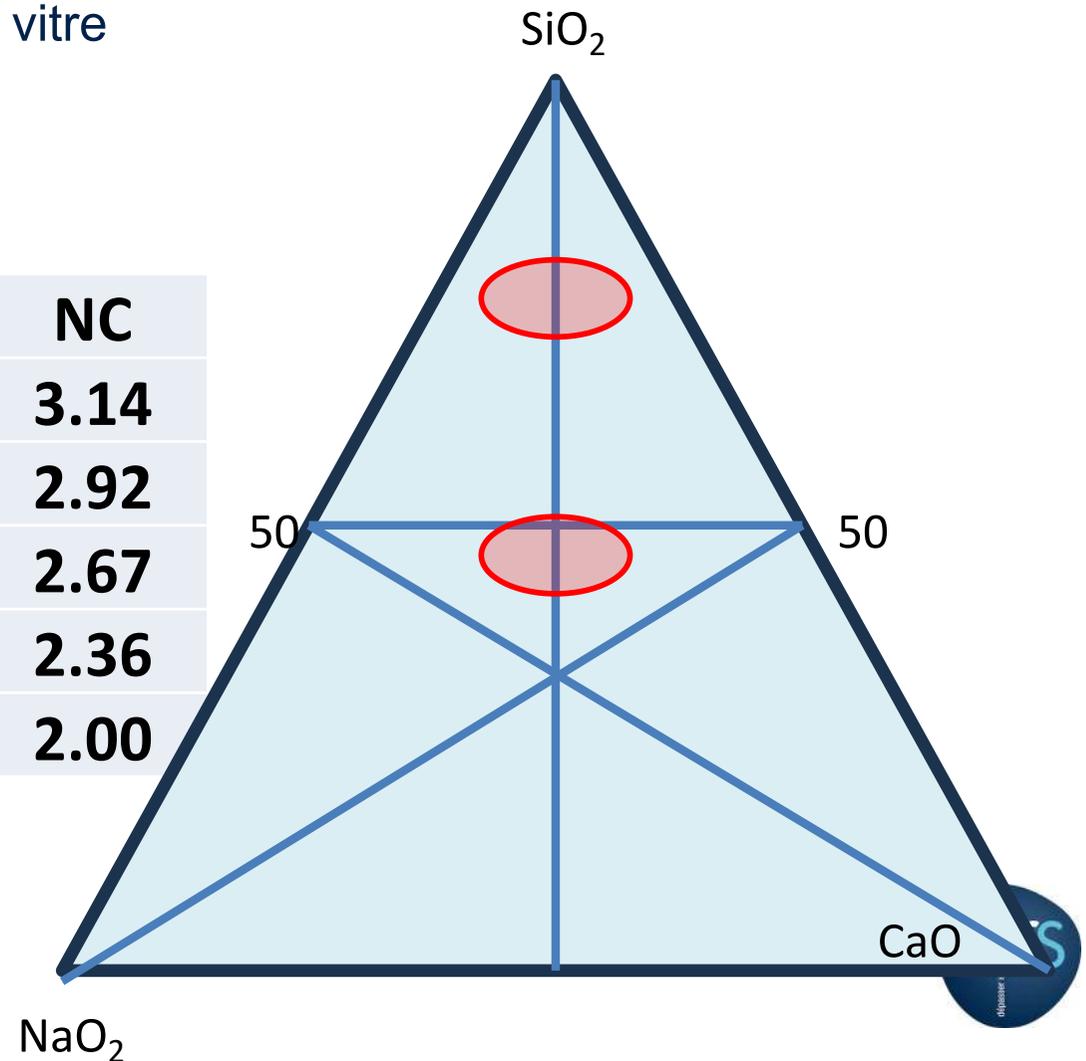
Composition (mol%):

$(70 - x) \text{ SiO}_2 - (15 + x/2) \text{ Na}_2\text{O} - (15 + x/2) \text{ CaO}$

Avec $x = 0 - 30$ et à $70 \text{ SiO}_2 = \text{verre à vitre}$

Glass	SiO ₂	CaO	Na ₂ O	NC
Si70	70	15	15	3.14
Si65	65	17.5	17.5	2.92
Si60	60	20	20	2.67
Si55	55	22.5	22.5	2.36
Si50	50	25	25	2.00

$$\text{NC} = (4 * \text{SiO}_2 - 2 * (\text{CaO} + \text{Na}_2\text{O})) / \text{SiO}_2$$

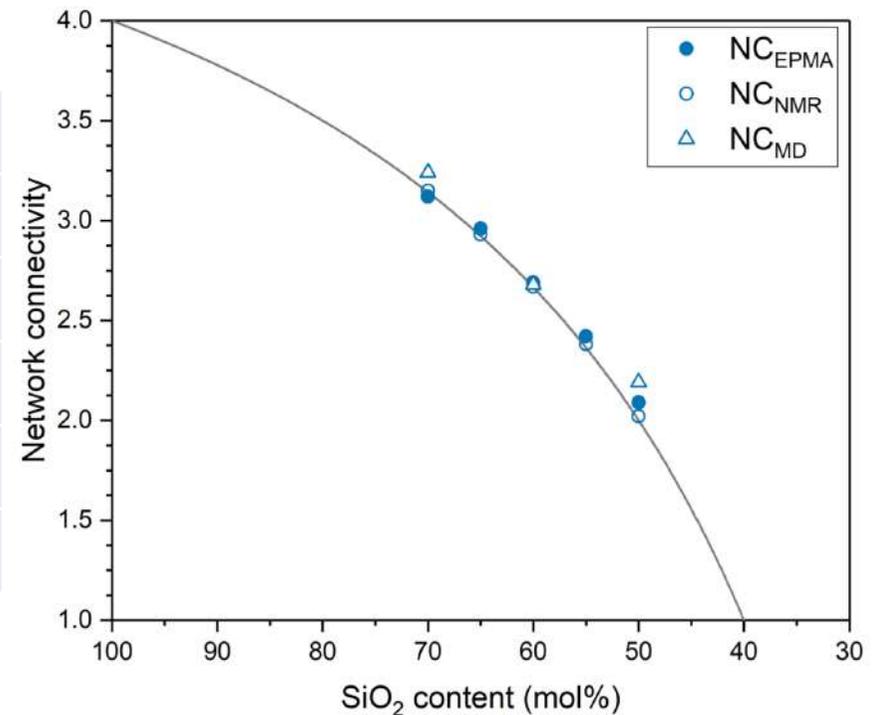


Composition (mol%):

$(70 - x) \text{ SiO}_2 - (15 + x/2) \text{ Na}_2\text{O} - (15 + x/2) \text{ CaO}$

Avec $x = 0 - 30$ et à $70 \text{ SiO}_2 = \text{verre à vitre}$

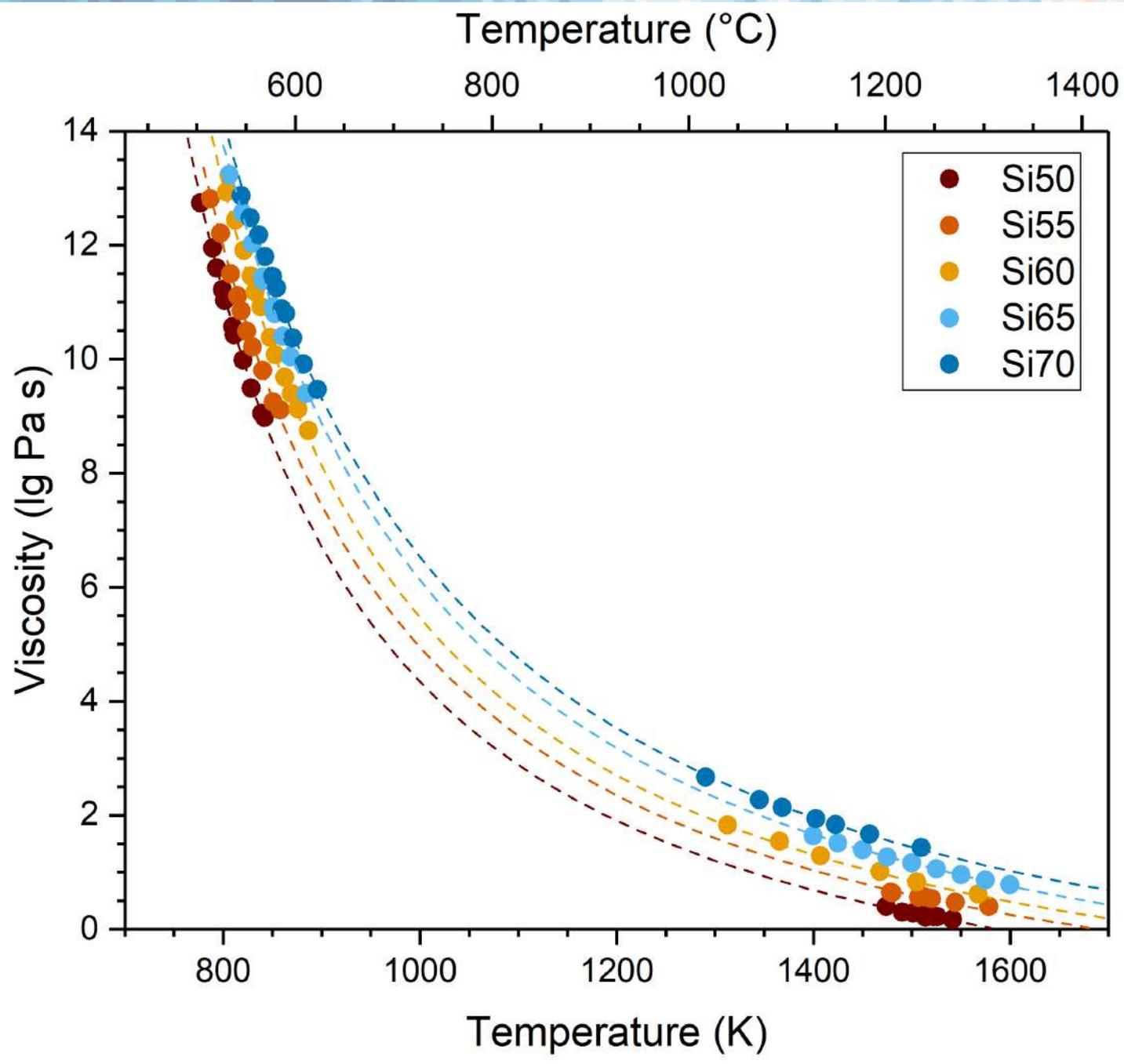
Glass	SiO ₂	CaO	Na ₂ O	NC
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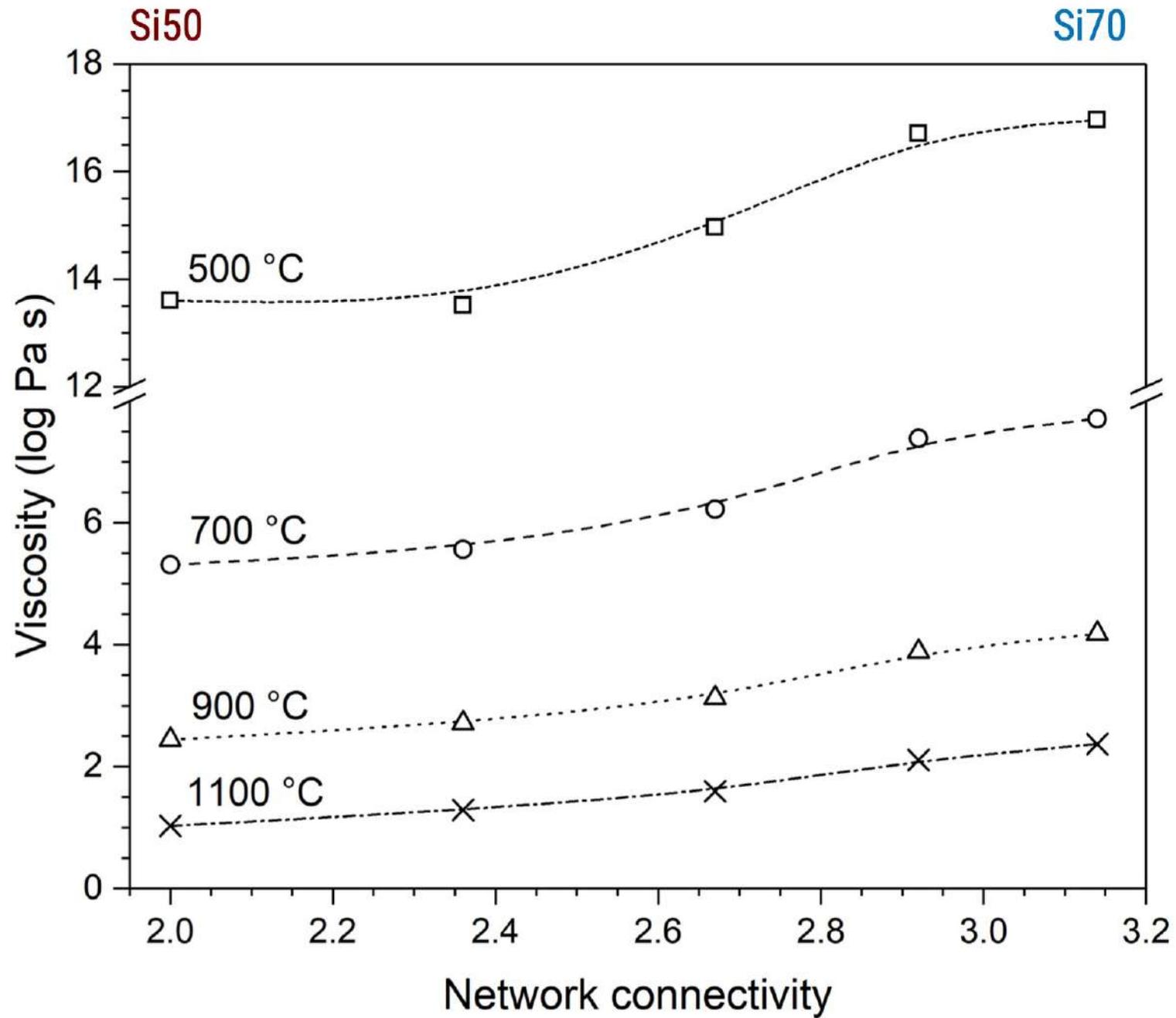


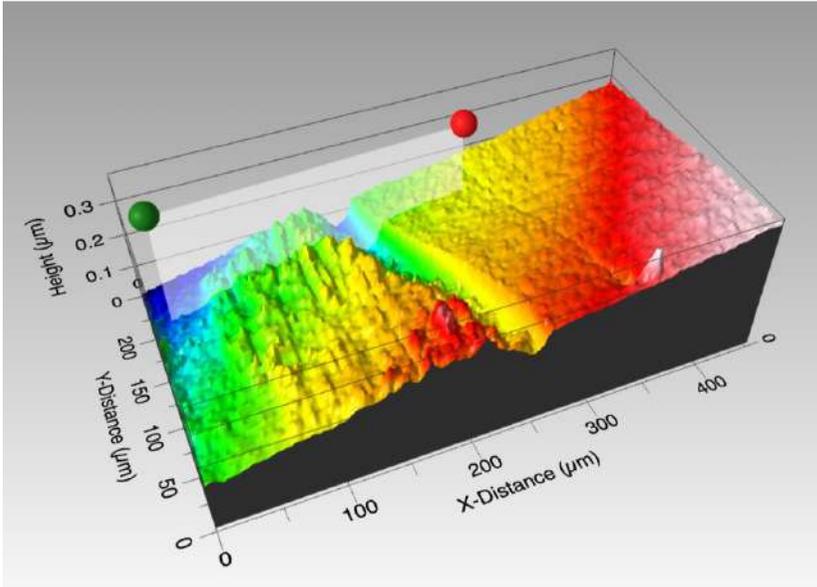
$$\text{NC} = (4 * \text{SiO}_2 - 2 * (\text{CaO} + \text{Na}_2\text{O})) / \text{SiO}_2$$



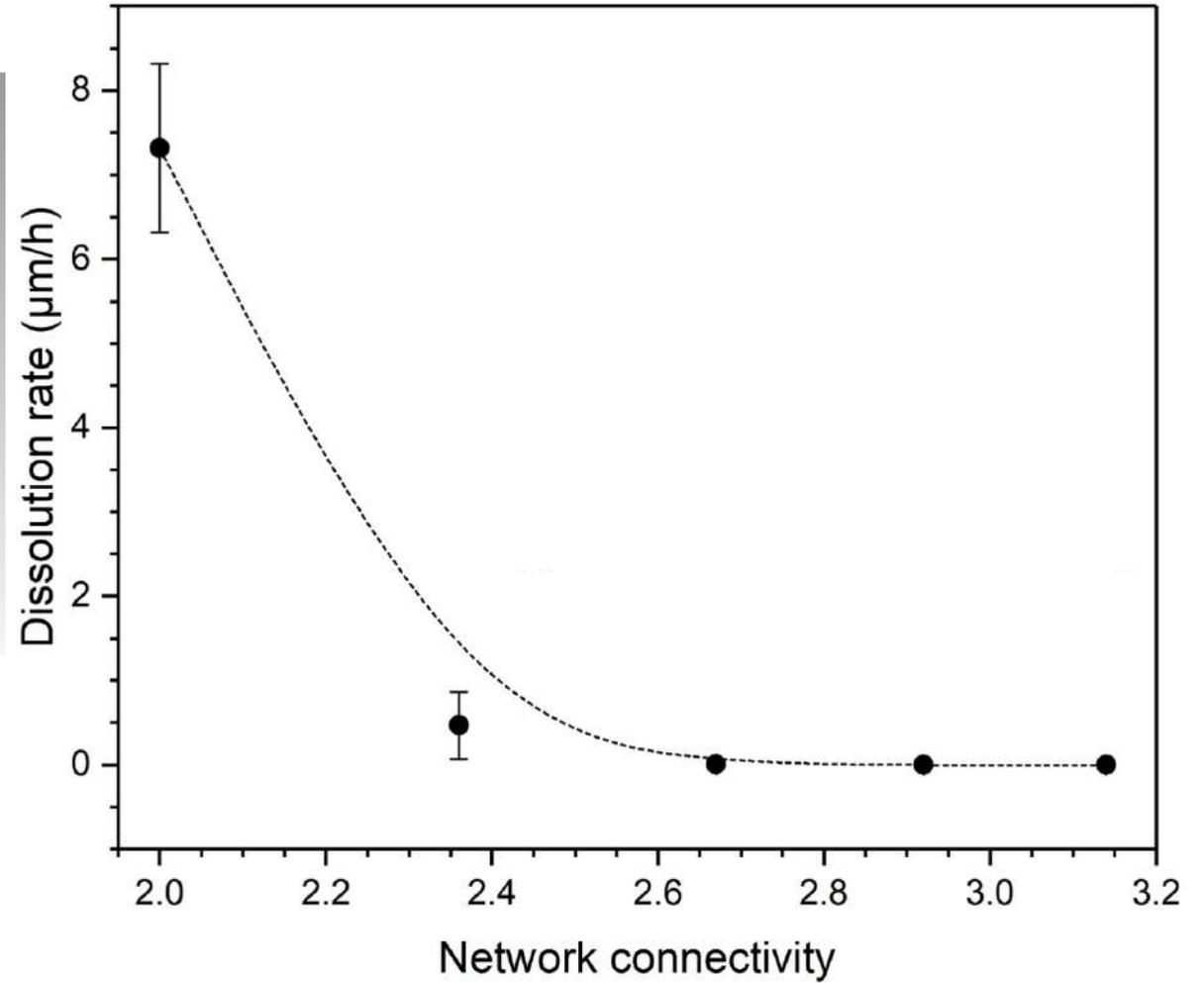
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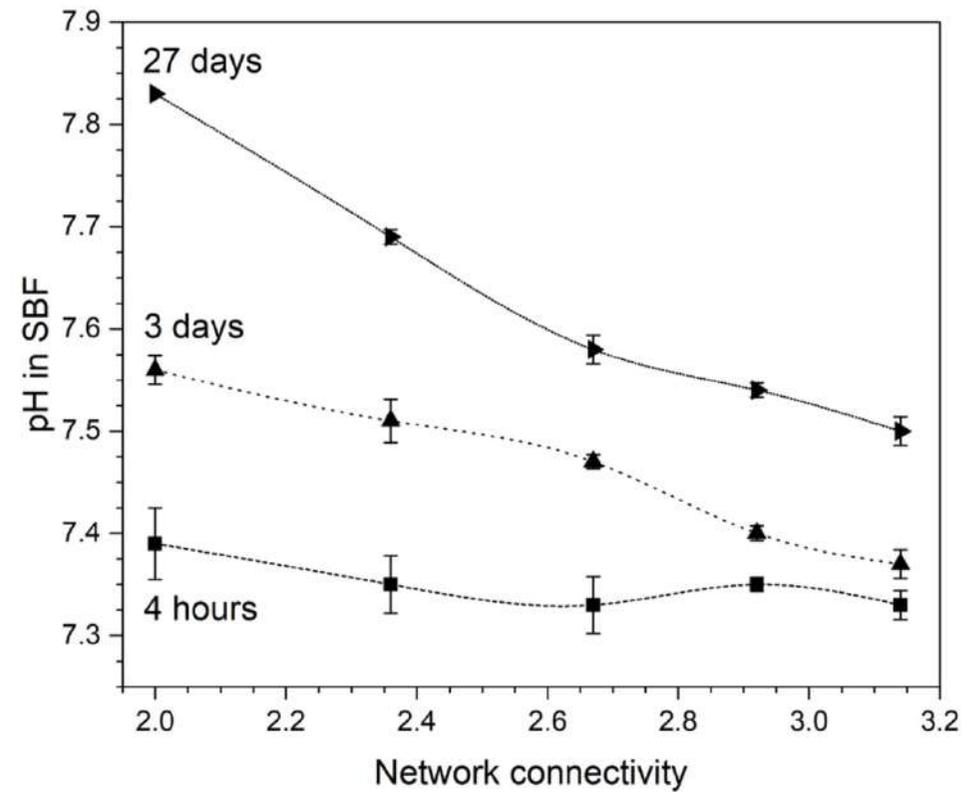
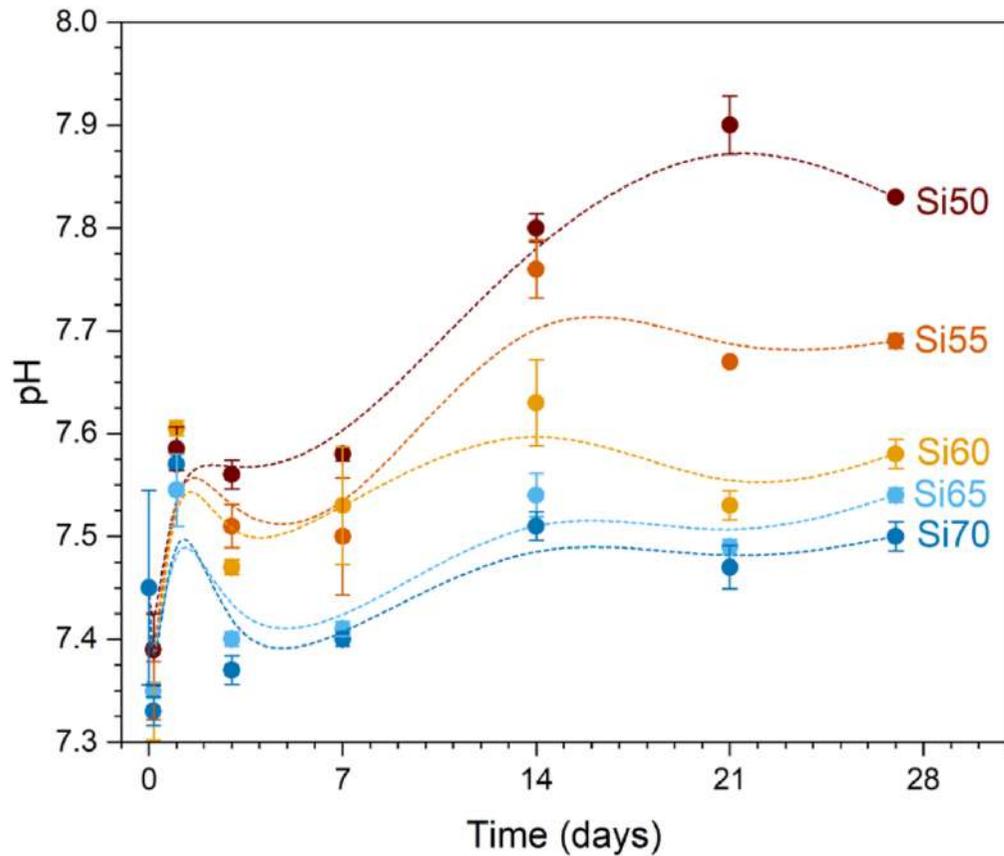




Dissolution dans Tris-HCl buffer solution (pH 7.4, 37°C)

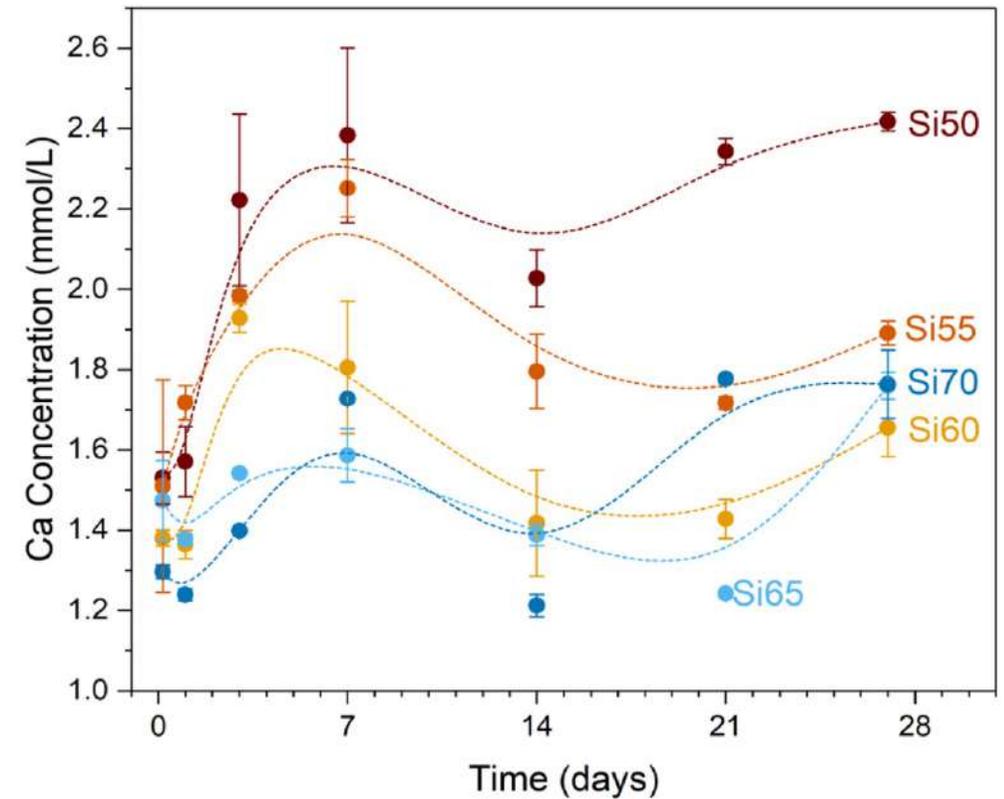
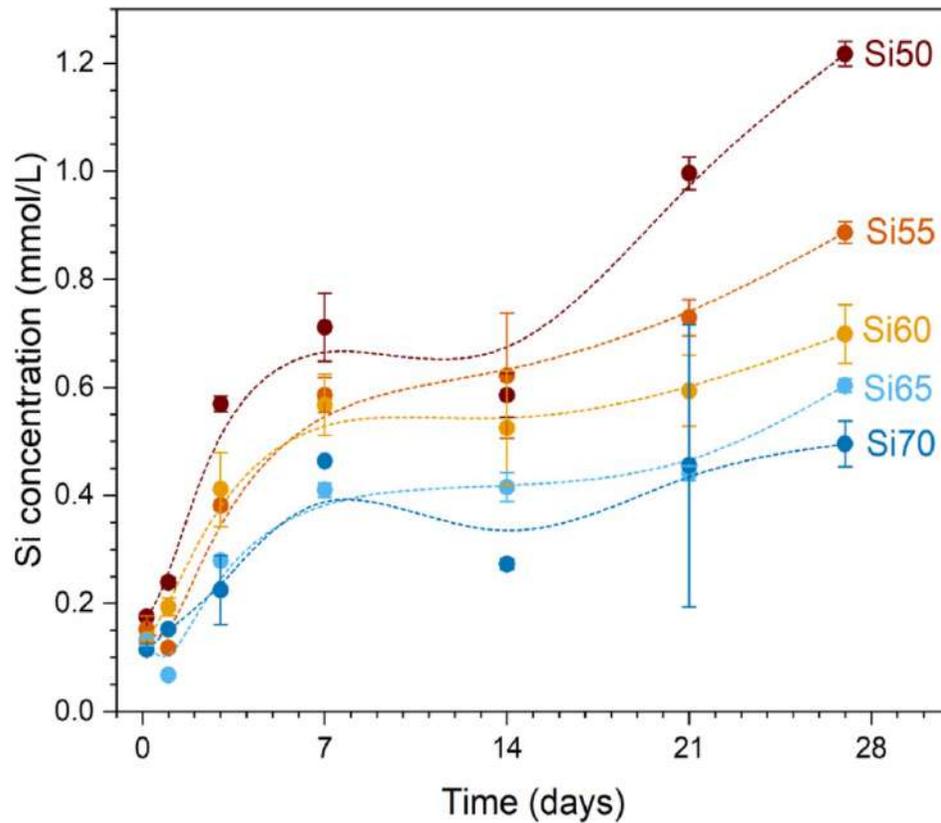


Comment évolue le Ph



Immersion du verre dans un liquide qui simule le fluide du corps (pH 7.4, 37°C)

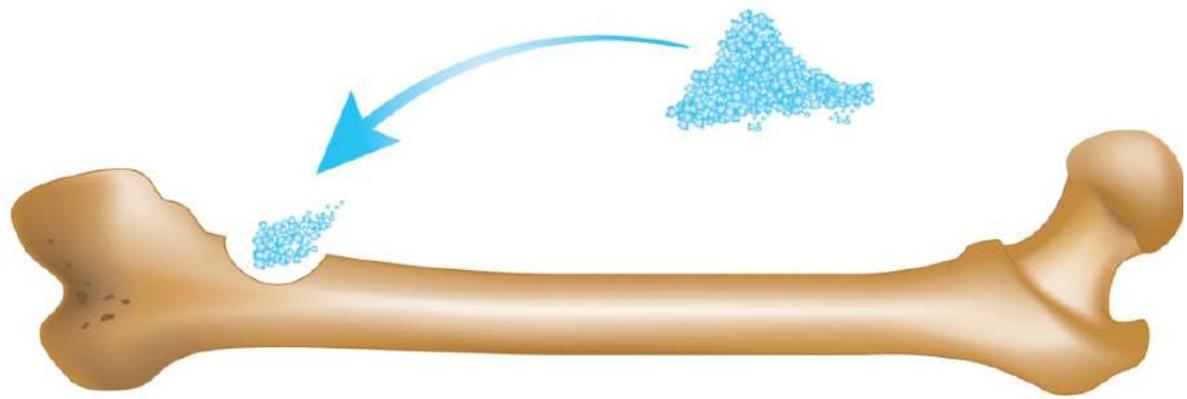
Comment évolue les cations relâchés?



Immersion du verre dans un liquide qui simule le fluide du corps (pH 7.4, 37°C)



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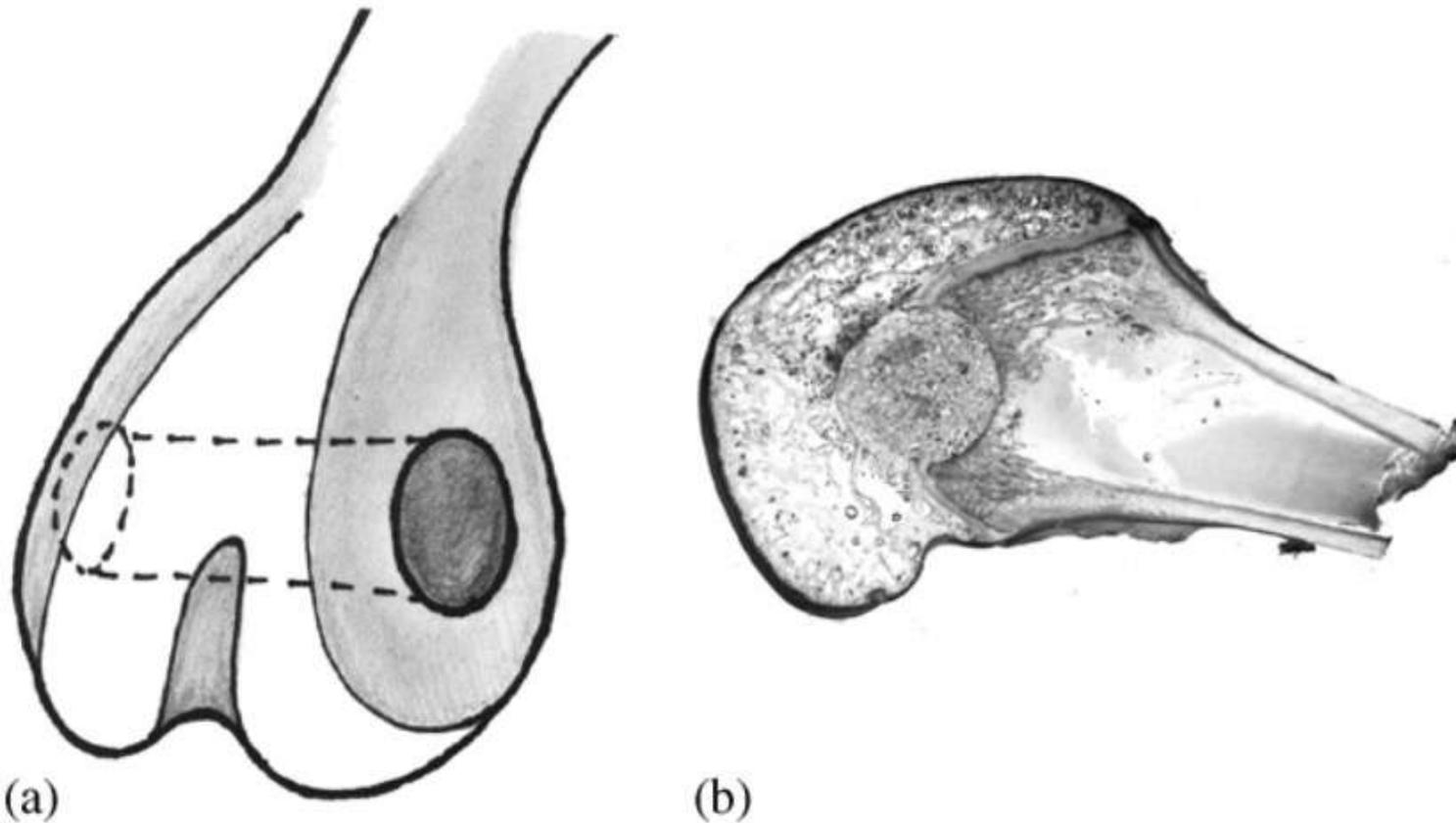
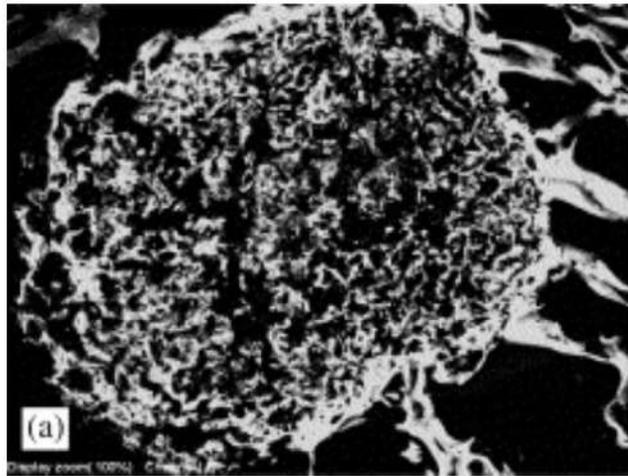
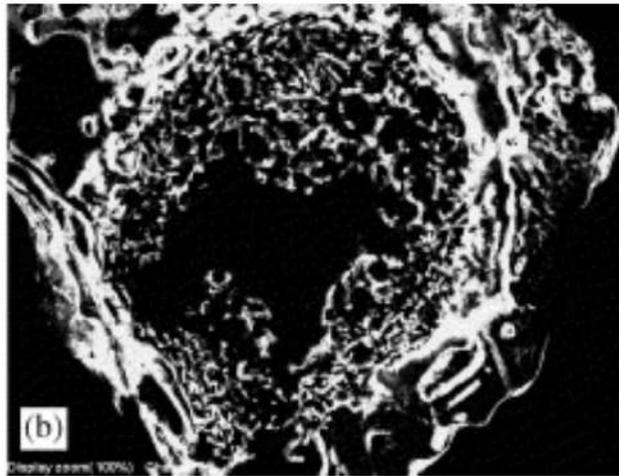


Fig. 1. (a) Schematic drawing of implantation: a 6-mm diameter hole was drilled into the femoral condyle; (b) cross-sections from the femoral condyle.

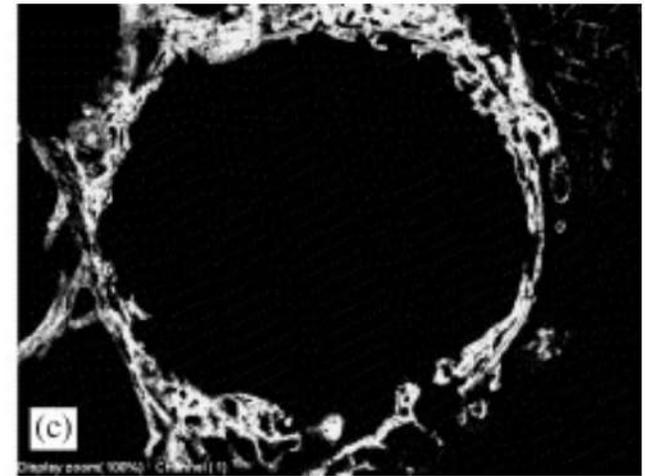
Si50



Si60



Si70



Granules de verres $\text{SiO}_2\text{-CaO-Na}_2\text{O}$ implantés dans un défaut du fémur (os de la cuisse) de lapins ; coloration à la calcéine fluorescente ; par microscopie confocale à balayage laser. Durée : 6 semaines

Traitement d'un kyste osseux dans le doigt d'un garçon de 2 ans



X-ray before surgery

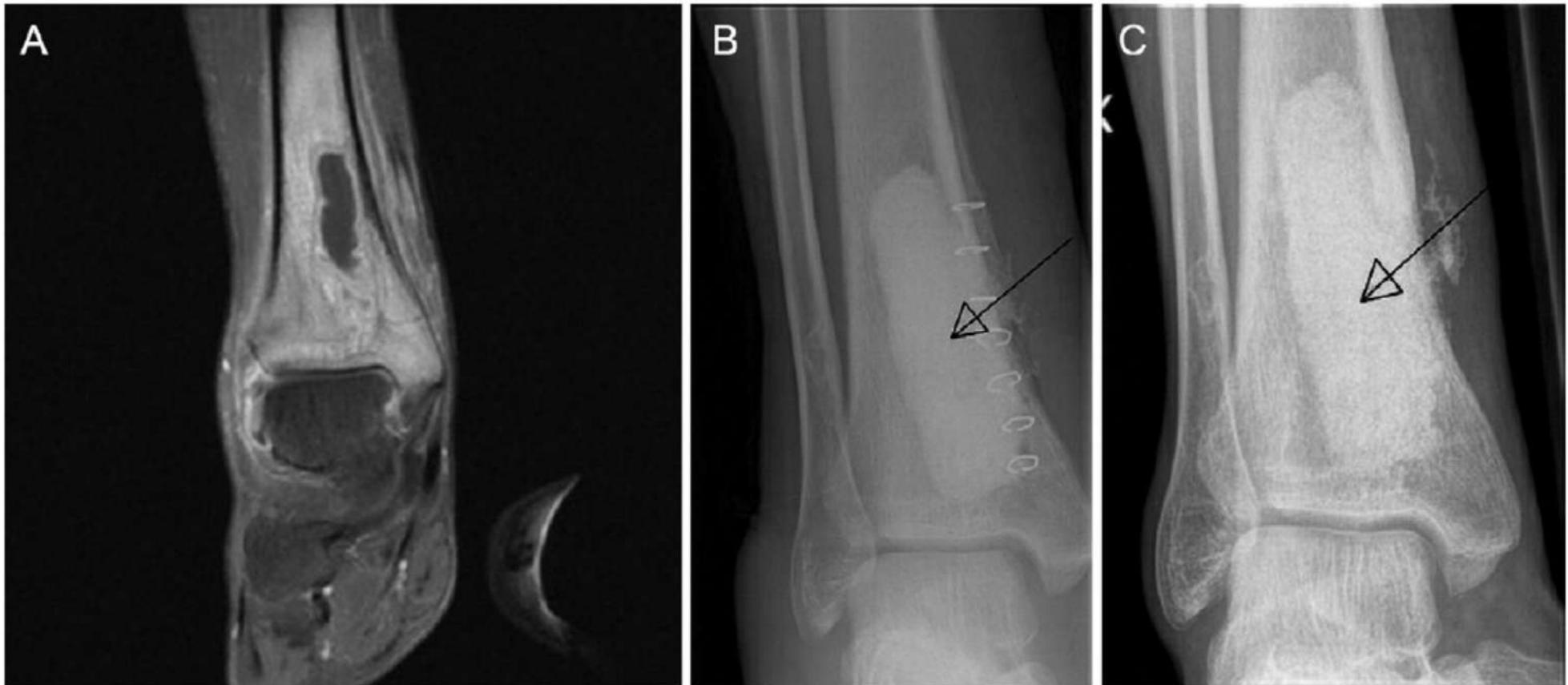


1 month after



2 years later

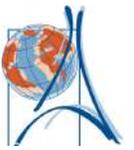
Traitement de l'infection osseuse chronique (ostéomyélite)



X-ray before surgery

after surgery

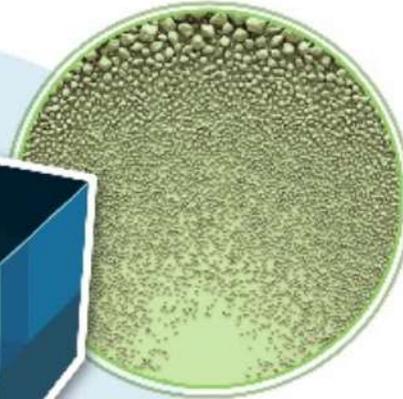
5 months later



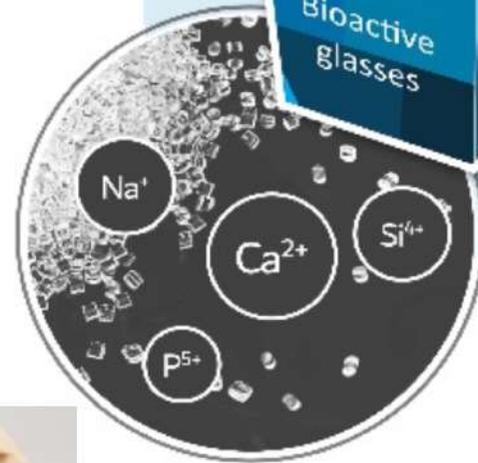
Bioactive glasses



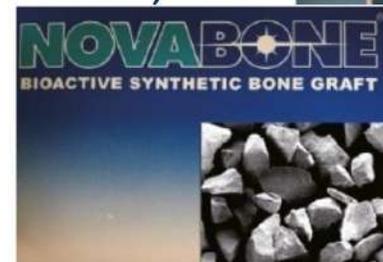
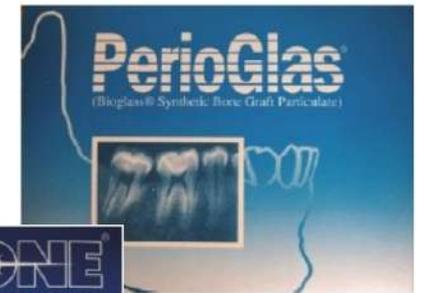
● Apatite formation



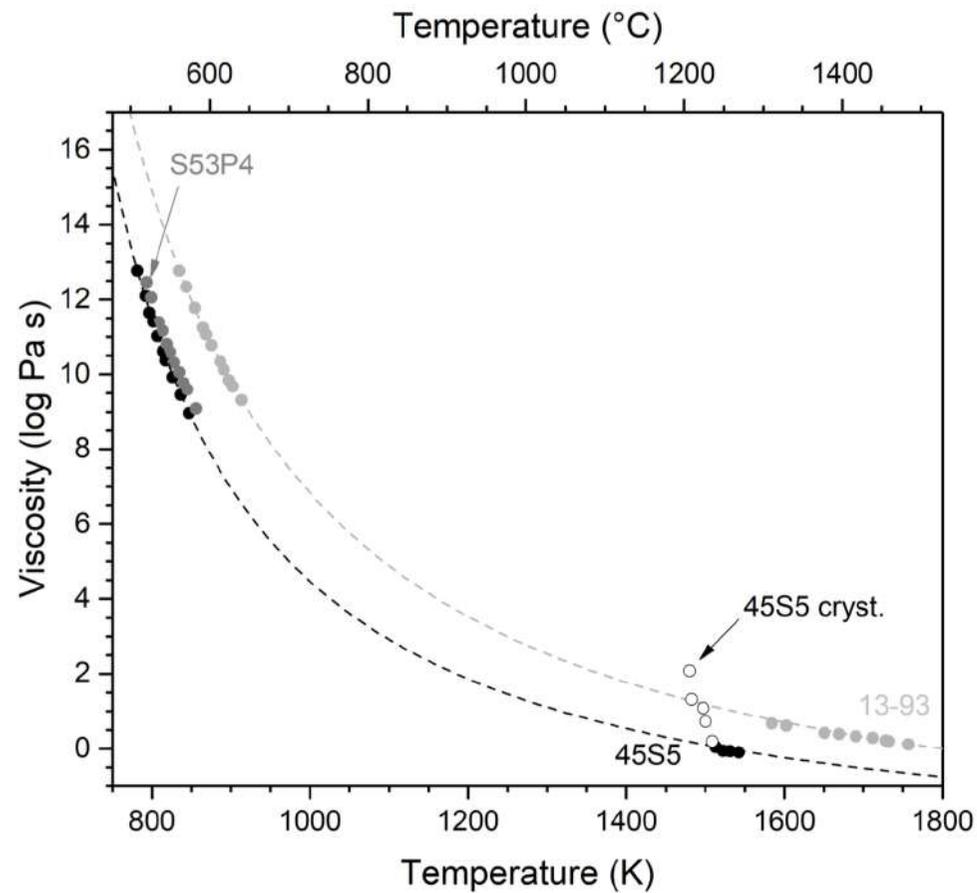
● Degradation



● Ion release
(therapeutic effects)



Glass	SiO ₂	P ₂ O ₅	CaO	Na ₂ O	MgO	K ₂ O	NC
45S5	46.1	2.6	26.9	24.4	-	-	2.12
S53P4	53.9	1.7	21.8	22.6	-	-	2.54
13-93	54.6	1.7	22.1	6.0	7.7	7.9	2.59



1 1.008* H hydrogen																	2 4.003 He helium	
3 6.94* Li lithium	4 9.012 Be beryllium																	10 20.18 Ne neon
11 22.99 Na sodium	12 24.31* Mg magnesium																	18 39.95 Ar argon
19 39.10 K potassium	20 40.08 Ca calcium	21 44.96 Sc scandium	22 47.87 Ti titanium	23 50.94 V vanadium	24 52.00 Cr chromium	25 54.94 Mn manganese	26 55.85 Fe iron	27 58.93 Co cobalt	28 58.69 Ni nickel	29 63.55 Cu copper	30 65.38 Zn zinc	31 69.72 Ga gallium	32 72.63 Ge germanium	33 74.92 As arsenic	34 78.97 Se selenium	35 79.90* Br bromine	36 83.80 Kr krypton	
37 85.47 Rb rubidium	38 87.62 Sr strontium	39 88.91 Y yttrium	40 91.22 Zr zirconium	41 92.91 Nb niobium	42 95.95* Mo molybdenum	43 [98] Tc technetium	44 101.1 Ru ruthenium	45 102.9 Rh rhodium	46 106.4 Pd palladium	47 107.9 Ag silver	48 112.4 Cd cadmium	49 114.8 In indium	50 118.7 Sn tin	51 121.8 Sb antimony	52 127.6 Te tellurium	53 126.9 I iodine	54 131.3 Xe xenon	
55 132.9 Cs caesium	56 137.3 Ba barium	57-71 La lanthanum	72 178.5 Hf hafnium	73 180.9 Ta tantalum	74 183.8 W tungsten	75 186.2 Re rhenium	76 190.2 Os osmium	77 192.2 Ir iridium	78 195.1 Pt platinum	79 197.0 Au gold	80 200.6 Hg mercury	81 204.4 Tl thallium	82 207.2 Pb lead	83 209.0 Bi bismuth	84 [209] Po polonium	85 [210] At astatine	86 [222] Rn radon	
87 [223] Fr francium	88 [226] Ra radium	89-103 Ac actinium	90 227.0 Th thorium	91 231.0 Pa protactinium	92 238.0 U uranium	93 [237] Np neptunium	94 [244] Pu plutonium	95 [243] Am americium	96 [247] Cm curium	97 [247] Bk berkelium	98 [251] Cf californium	99 [252] Es einsteinium	100 [257] Fm fermium	101 [258] Md mendelevium	102 [259] No nobelium	103 [266] Lr lawrencium		
		57 138.9 La lanthanum	58 140.1 Ce cerium	59 140.9 Pr praseodymium	60 144.2 Nd neodymium	61 [145] Pm promethium	62 150.4 Sm samarium	63 152.0 Eu europium	64 157.3 Gd gadolinium	65 158.9 Tb terbium	66 162.5 Dy dysprosium	67 164.9 Ho holmium	68 167.3 Er erbium	69 168.9 Tm thulium	70 173.0 Yb ytterbium	71 175.0 Lu lutetium		

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Glass, an ubiquitous material / *Le verre, un matériau omniprésente*

Glass, an ubiquitous material

Le verre, un matériau omniprésent

Daniel R. Neuville[✉]

- Tous les éléments et toutes les liaisons chimiques:
- covalentes
 - ioniques
 - métalliques
 - Van der Waal's
 - Hydrogène

=> Verre d'oxydes, de chalcogénures, métalliques, d'halures, organiques et toutes les combinaisons possible

