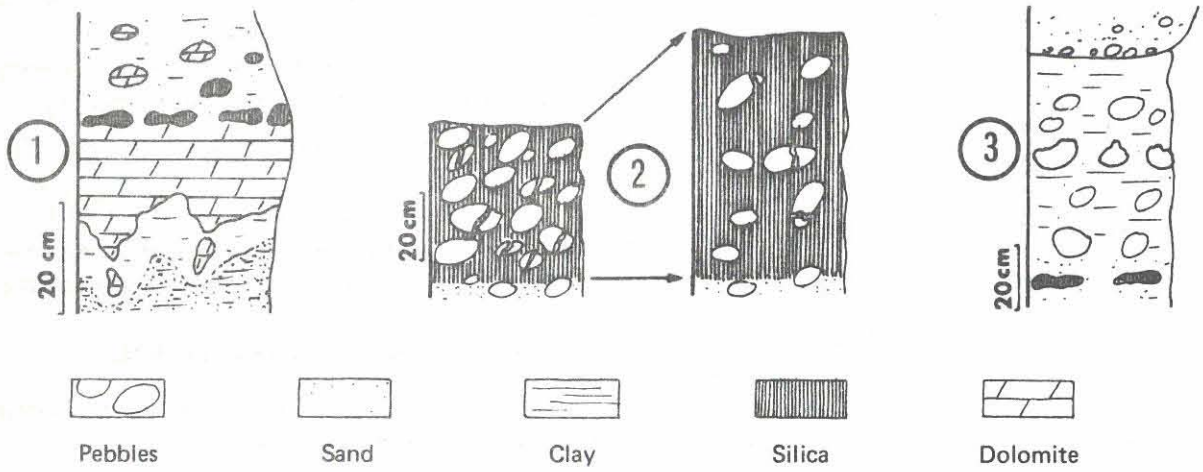
Extr. 10th Internat. Congr. Sedimentology, Jerusalem, 9-14 juillet 1978, thème 3.

FOSSIL SILCRETES IN UPPER PERMIAN AND LOWER TRIASSIC OF NORTH-EASTERN FRANCE

M. DURAND and R. MEYER

Département de Géologie, Université de Nancy I, CO 140 - 54037 Nancy cédex, France.

In these series made up of feldspathic sandstones, silcretes appear in the so-called «Zones violettes» or «Karneol-Dolomit-Horizonte» which are seen as paleosols (1). These silcretes are very varied in detail ; however they all seem to belong to one of the few types which are sketched in the following figures.



1) Silicification appears in nodules, often crossed by shrinkage cracks. Some nodules have a dolomitic cortex or are entirely dolomitic. Under the nodules, massive dolomite shows an irregular base underlined by some cm of green clay.

2) The matrix of a conglomerate is entirely silicified. Silica even fills cracks which often appear through the pebbles. Irregular foldings and diapiric shapes are usual. Over a few meters, a thin silcrete including many joining pebbles can turn into a thick one with pebbles floating in a silicified matrix.

3) Lenticular white silicified concretions, with a green clay boundary, develop in a white sandstone at the bottom of a sandy-clay purple horizon. Pebbles are numerous in this matrix ; some are very weathered but only at their upper face.

Under the light microscope, dolomite and silica show the following aspects :

– dolomite : automorphic rhombs or crystals with hacksaw terminations in an iron-rich clayey matrix ; microcrystalline mosaic.

– silica : mega and microcrystalline quartz, cryptocrystalline quartz, length-fast calcedony, length-slow calcedony.

Reactions happened between these minerals :

. Dolomite could replace any mineral existing in the rock, almost never preserving the shape of the replaced mineral.

. Quartz crystallised in holes of the host rock from solutions.

. Length-fast calcedony crystallised from a silica gel in holes.

. Length-slow calcedony appeared only replacing other minerals : clays, dolomite, gypsum. It is typical of replacements, even when the replaced mineral is not an evaporite.

Chemical analyses show that Al vanished from the rock during silicification, proving its mobility. Ti content decreases in those silcretes, to the contrary of what is sometimes observed in recent silcretes (2) ; it shows a good correlation with Al (0.88), thus it is probably linked to sheet silicates.

Clay minerals are dominantly illite, kaolinite being largely subordinate. The green clay often associated with dolomite and always with silicifications is ferri-illite : $Fe^{3+} / Fe^{2+} > 3$ (3). In the series studied, such an illite exists only in the «Zones violettes».

Considering the structures and textures of these silcretes and the observed and replaced minerals, it is possible to imagine the environments before silica invasion :

– In vertisols there is a strong churning which could give the features observed here. Ferric smectites are described in these soils (4) ; during diagenesis, those smectites could give the ferric illite observed.

– Dolomite and silicified rhombs seem to show that in some cases silcretes were previously calcretes or dolocretes.

– Environments where salinity changes must also be considered ; some observations, such as rhombs grown in two times, are similar to those made in the «schizohaline environment» previously described (5).

Here the liberation of silica cannot be seen in environments where solutions are very diluted (6) ; it is necessary to look towards relatively concentrated solutions :

– Lakes or groundwaters where Magadi-type chert precursors can appear (7).

– Solodized solonetz (natragids ?) could have provided silica if we consider that their evolution could have been much longer at that time than during a Quaternary evolution. A strong weathering of pebbles was observed in some aridisols (8).

– When carbonates invade the sediment, silicates can decay and give silica as a by-product.

The environments proposed here exist in arid and semi-arid climates. They can be close to one another in the same landscape and this explains the numerous facies changes observed in the field.

---

(1) ROPER H.P. and ROTHE P. (1975). – IXth I.A.S. Congr. Nice, th. 2, pp. 113-120.

(2) SMALE D. (1973). – Journ. Sed. Petrol., 43, pp. 1077-1089.

(3) DURAND M. (1975). – C.R. Acad. Sci., Paris, 280-D, pp. 2737-2740.

(4) TRAUTH N., PAQUET H. et MILLOT G. (1967). – C.R. Acad. Sci., Paris, 264-D, pp. 1577-1579.

(5) FOLK R.L. and SIEDLECKA A. (1974). – Sedim. Geol., 11, pp. 1-15.

(6) PARRON C., NAHON D., FRITZ B., PAQUET H. et MILLOT G. (1976). – Sci. géol., Bull., 29, pp. 273-284.

(7) MAGLIONE G. (1975). – IXth I.A.S. Congr. Nice, th. 1, pp. 109-113.

(8) ROZANOV A.N. (1951). – Israel Progr. for Sci. Transl., Jerusalem, 1961.