LET'S TALK ABOUT LIMESTONE - PART 2 - A LIMESTONE FAIRY TALE

- Andy Spate

As I indicated in the ANDYSEZ before last, and repeated in the introduction to Professor Grimsley's excellent piece in the last issue of the Journal, I am going to talk a little more about limestone. As we have seen limestone is made up of calcium carbonate (and that there are variations with some of the calcium being increasingly replaced by magnesium) and that there are impurities. But where does it come from...

Once upon a time, a very, very long time ago (before about 3,300,000,000 years ago) there wasn't any limestone (nor even proto-dragons!). And there was something wrong with the atmosphere - there was more carbon dioxide than oxygen. However, proto-dragons began to appear and the great explosion of life began which culminated in the highest life forms yet known (lawyers? cave guides? IOKs? Ministers of the Crown?). These life forms began to use the carbon dioxide and the oxygen and the calcium dissolved in the oceans in increasing quantities to make their skeletons - inside and outside. The composition of the oceans changed such that below an equilibrium depth the levels of dissolved gases and the metal calcium were such that the solid mineral calcite precipitated from solution. The fixing of gases and dissolved metals into limestone, dolomite and so on had begun.

From this time onward the amount of carbonate rock increased dramatically and because there was more around and because it was being re-dissolved and physically reworked and re-deposited a greater variety of carbonate rocks appeared. Indeed, as Jennings (1985) says of limestones:

> No common name cover so much variety as does limestone. This is because a wide range of materials - detrital, organic and chemical - accumulates originally and because *diagenesis* - change at low temperature and pressure - is intense through their chemical susceptibility. High temperature and pressure may also metamorphose them to marble, a mosaic of large, clear calcite grains, but limestones become so completely crystalline in diagenesis that they may easily be labelled marble without metamorphism (page 9).

Because of their complexity, many classifications of limestone have emerged. Some basic introductions to these classifications are given in Jennings (1985), Ford and Williams (1989) or Gillieson (1996). Whole shelves of books are devoted to carbonate petrology, depositional environments and so on. Best not confuse our shelves with elves.

Let's try and keep it fairly simple. Ford (1976) suggests that limestones are made up of four basic minerals as follows:

Calcite $CaCO_3$: the skeletal material of most marine invertebrates and the main component of limestones.

Aragonite $CaCO_3$: the skeletal material of some marine molluscs; sometimes precipitated in warm shallow waters. Compared to calcite it is less stable and more soluble; it often recrystallises to calcite.

Dolomite $CaMg(CO_3)_2$: little known as a primary sedimentary mineral, but commonly results from the invasion of calcite sediments by magnesium-rich brines which cause recrystallisation with dolomite replacing calcite.

Chalcedony SiO_2: The siliceous skeletal material of a few marine invertebrates, notably Radiolaria. Commonly present in limestones as flint and chert nodules.

Ford goes on to present the following table:

COMPONENTS OF LIMESTONE

DESCRIPTION	GENESIS
Skeletal	Faunal (e.g. corals, brachiopod shells, etc.)
	Floral (e.g. algal stem fragments)
Encrustations	Physico-chemical (e.g. ooliths, pisoliths)
	Algal (e.g. blue-green algal crusts)
	Weathering products (e.g. travertine, stalactite)
Pellets	Faecal
	Bahamite pellets (pseudo-ooliths)
	Algal
Limeclasts	Intra-clasts - fragments of lime sediment from the immediate environment
	Extra-clasts - fragments of limestone from older formations
Micrite	Automicrite - calcilutite formed in the immediate environment
	Allomicrite - calcilutite transported from an external source
Sparite	Crystalline cementing material, granular, drusy or fibrous
Biolithite	Organic growth *in situ*, such as algal stromatolites, coral reefs, etc.

Well, that has made it complicated enough for now. What the hell is *calcilutite*, I hear you cry! Or indeed *drusy*? The former is a limestone of "lime muds, with grains smaller than 0.02 mm". Drusy = appearance of being covered in small crystals. That is enough for now, my children. The story continues...

REFERENCES

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