Climatic conditions during the Holocene based on Levantine continental shelf sediment cores

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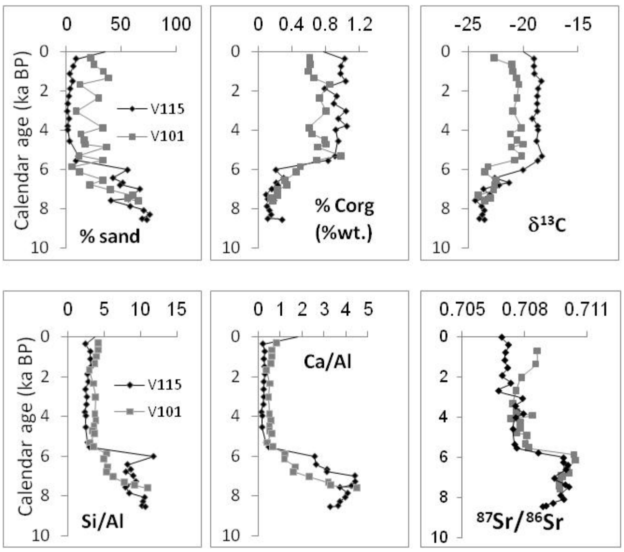
Sediments deposited on the southeastern continental shelf of the Levantine Basin are sensitive recorders of climatic and oceanographic variability affected by the north Atlantic and indirectly by monsoonal systems. In order to reconstruct the influence of these climatic systems on Holocene sediments two cores were taken off shore the southern (V115) and central (V101) Israeli coast at water depths of ~35 m. The cores, dated to 7, 630 and 8, 440 ^{14}C years BP, show two distinct sedimentation regimes. High rates, of 190-140 cm/ka, in the lower Holocene, and significantly lower rates of 50-60 cm/ka during the last 5, 500 years. The cores were analyzed for grain size, TOC, $\delta^{13}C$, major and trace elements, and Sr isotopes. Selected results are shown in the figures below. The full data set indicates clearly that two distinct climatic periods governed the eastern Mediterranean and its surroundings during the Holocene.



Timescales of eruption triggering and magma transport from element diffusion in minerals

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Mixing of magmas of contrasting temperatures and compositions can act as a trigger of a subsequent volcanic eruption. Heating of a magmatic system by basaltic injection can remobilise magma that is close to its solidus, and mixing can further change the character of the magma, lowering viscosity and promoting eruption.

Upon mixing, if the magma system remains saturated in mineral phases inherited from one or both parental melts, strongly-zoned mineral grains will form, as a product of changes in mineral-melt equilibria and melt composition. Subsequent residence at magmatic temperatures will allow such abrupt chemical zoning profiles to relax by diffusion. If magma temperatures are known, we can place constraints on diffusion time and thereby investigate the amount of time that passes between a magma injection – ultimately our eruption trigger – and the ensuing eruption.

Study of large silicic systems implies crystal residence times at magmatic temperatures of the order of tens of years (e.g. Whakamaru Ignimbrite, NZ, [1]) to thousands of years (e.g. Fish Canyon Tuff, USA, [2]), which is still relatively rapid given the large volumes concerned. Looking at smaller systems, the Nea Kameni Dacite of Santorini suggests a remobilisation time of the order of a month between basaltic injection and dacite eruption [3], whilst study of the recent Eyjafjallajokull eruption of 2010 resolves multiple mixing events occurring in the months prior to, and during, the eruption. In contrast, work on Piton de la Fournaise volcano is less clear-cut, and perhaps sounds a cautionary note for determining magmatic timescales from diffusion profiles.

Developments of new software tools and methodologies, and the utilisation of new mineral-element systems promise an expansion of these techniques. However, the petrological context has to be a major concern in these studies as it entirely determines the significance of the results.

[1] Saunders, Morgan, Baker & Wysoczanski (2010) *Journal of Petrology* **51**, 2465–2488. [2] Charlier, Bachmann, Davidson, Dungan & Morgan (2007) *Journal of Petrology* **48**, 1875–1894. [3] Martin, Morgan, Jerram, Caddick, Prior & Davidson (2008) *Science* **321**, 1178.