The French Alps - classic geology re-interpreted in the light of passive margin geology and allocthonous salt tectonics*

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*Abstract from 2011-2012 AAPG Foundation Distinguished Lecture presentation.

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Just as an understanding of structural geometry in the field is essential in the interpretation of seismic data, so sometimes seismic data and the new ideas that stem from it enable us to see classic field geology in a completely new light, even though the data may come from a completely different geological setting or a totally different part of the world. This lecture describes how, a few years ago, our understanding of the geological evolution of one of the worlds classic mountain belts was transformed by reference to data obtained from the Atlantic passive margin, and how at the present time, our increased understanding of salt tectonics might be bringing about a similar shift in thinking.

The understanding of salt tectonics has been transformed in recent years by the seismic imagery in places like Brazil and the Gulf of Mexico, augmented by inspirational physical modelling. I will try to apply this new knowledge to geology 'on the ground' in the sub-Alpine chains of Haut Provence in the south western Alps. In this part of the world, a very well exposed Mesozoic sequence showing rapid thickness and facies changes associated with Jurassic and Cretaceous extension on the margin of the Ligurian Tethys, has been deformed by a series of 'Alpine' compressional events which occurred from the Late Cretaceous to the Pliocene. Although the geology has been very well known for decades, aspects of the structure remained enigmatic and could not be explained by either Mesozoic extension or Alpine shortening alone. This talk will make the case that they resulted from salt tectonics which occurred not in the developing Alpine mountain chain, but on the sea bed of a Late Jurassic continental slope, analogous, perhaps, to the Gulf of Mexico today.

A completely overturned , highly condensed Jurassic section is interpreted as the elevated roof of a salt body in a deep marine setting which overturned as a 'flap' in the Middle Jurassic as allochthonous salt broke out at the sea floor Later, Alpine compression exploited the weakness of the salt sheet as a major thrust but though the 'flap' is in the footwall of the thrust, evidence of soft-sediment deformation and other anomalous structures within the flap suggest that it cannot have originated as an overturned footwall syncline.

The ideas are prompted by seismic, the conclusions rely heavily on conventional field evidence. We geologists should never lose sight of our field-based roots.