General Theme 1
1.1

An emerging issue in carbonate sedimentology is ocean acidification and its devastating effect on carbonate systems. The rapid pumping of fossil fuel-derived CO_2 in the atmosphere is forcing the world's ocean to buffer itself at a rate probably never experienced in the geological past. This phenomenon lowers the pH of the oceans while the lysocline and compensation depths of aragonite and calcite shoal rapidly in response. Lysocline shoaling and ocean acidification is enhanced in upwelling zones as the pCO_2 of upwelled waters can be as high as 1000 ppm, i.e. more than twice normal values. This makes the "upwelling environment" a unique laboratory where some of the scariest predictions of marine environmental disasters can be tested, both in modern and ancient settings. Yet, the "upwelling environment" has only received passing mentions by carbonate sedimentologists studying ancient rock successions who have failed to recognize what is different about it, either the processes that are at play or the geological products thereof. Upwelling brings cool- and nutrient-rich water to shallower levels, which in turn enhances productivity, which itself leads to draw dawn of oxygen, creating potentially lethal anoxic conditions in close proximity to carbonate factories. In turn, the associated increase in pCO_2 generates low pH waters that can easily fall below aragonite and magnesian calcite saturation, thus creating apparent shifts from aragonite to calcite seas. Modern carbonate factories affected by upwelling are rare with the exception of the Galapagos Islands which are regularly affected by equatorial upwelling, a phenomenon which is regulated by ENSO (El Niño Southern Oscillation). Ancient carbonate systems affected by upwelling are far more common. This session will examine the linked phenomenon of ocean acidification and its enhanced effect on modern and ancient carbonate factories in zones of coastal or equatorial upwelling.