Geophysical Research Abstracts
Vol. 12, EGU2010-15739, 2010
EGU General Assembly 2010

Spain as an emergency air traffic hub during volcanic air fall events? Evidence of past volcanic ash air fall over Europe during the late Pleistocene

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Past volcanic eruptions often leave visible ash layers in the geological record, for example in marine or lake sedimentary sequences. Recent developments, however, have shown that non-visible volcanic ash layers are also commonly preserved in sedimentary deposits. These augment the record of past volcanic events by demonstrating that past ash dispersals have been more numerous and widely disseminated in Europe than previously appreciated. The dispersal 'footprints' of some large late Pleistocene European eruptions are examined here in the light of the recent Eyjafjallajökull eruption. For example, the Vedde Ash which was erupted from Iceland around 12 thousand years ago, delivered distal (and non-visible) glass deposits as far south as Switzerland and as far east as the Ural Mountains in Russia, with an overall European distribution remarkably similar to the dominant tracks of the recent Eyjafjallajökull plumes.

The Eyjafjallajökull eruption has demonstrated that relatively small amounts of distal volcanic ash in the atmosphere can seriously disrupt aviation activity, with attendant economic and other consequences. It has raised fundamental questions about the likelihood of larger or more prolonged volcanic activity in the near future, and the possibility of even more serious consequences than those experienced recently. Given that there are several other volcanic centres that could cause such disruption in Europe (e.g. Campania and other volcanic centres in Italy; Aegean volcanoes), a key question is whether there are parts of Europe less prone to ash plumes and which could therefore operate as emergency air traffic hubs during times of ash dispersal. Although not generated to answer this question, the recent geological record might provide a basis for seeking the answer. For example, four palaeo-records covering the time frame of 8 – 40 Ka BP that are geographically distributed across Spain have been examined for non-visible distal ash content. All four have proved to be almost devoid of volcanic ash, which contrasts with results obtained from sites throughout central and northern Europe. This suggests that Spain has remained free of ashfall events throughout the late Pleistocene, or that any ash dispersal over Spain has been short-lived and/or infrequent. This appears to accord with the pattern of dispersal of Eyjafjallajökull ash clouds over April to May 2010. Most of the active period was characterised by low eruptive columns and the tropospheric dispersal of ash. Under these conditions, ash dispersal was multi-directional from eastern Europe to Greenland and beyond, but did not encroach on to the Iberian peninsula. In contrast, when the eruptive columns became more elevated and entrained in the jet stream, the dispersal directions were more uni-directional and passed over Iberia and North Africa. Thus the apparent lack of volcanic ash in Iberia (10 – 40ka) may have as much to do with eruptive column height and volcano location as with circulation patterns (tropospheric v. stratospheric). A more comprehensive assessment of geological records of non-visible ash layers in selected sites may hold the key to examining this matter more robustly.