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A new plate tectonic model of crustal extension of rheologically weakened lithosphere resulting from recurrent tectonic switching above Paleozoic subduction zone

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We present a large scale plate tectonic model of Paleozoic crustal extension affecting thermally weakened lithosphere based on high resolution geochronology, magmatic and metamorphic petrology and geophysical studies (paleomagnetism, AMS and seismic profiling). In this model, it is shown that the Vosges orogen originated through Devonian to Lower Carboniferous (360 – 340 Ma) back-arc and magmatic arc developed on Neo-Proterozoic crust in front of south-east directed subduction. The intracontinental arc and back arc region was compressed during Lower Carboniferous (335 Ma) shortening leading to development of 40 km thick orogenic root, imbrication of lower crust and mantle and subsequent compressional heterogeneous extrusion of lower crustal rocks. This period was followed by migration of magmatic arc to the north and development of extensional core complex and low pressure remelting of exhumed granulites in the former arc- back-arc-root area (330 – 325 Ma). Finally the northern magmatic arc region collapsed in form of crustal scale cauldron subsidence event in continuity with extensional deformation to the south. We propose a model of tectonic switching associated with change of dip and successive retreat of northerly subduction zone from early steep subduction, followed by slab flattening and final subduction zone steepening and retreat. The ECORS seismic profiling and field structural pattern show that the Carboniferous extensional lower and upper crustal deformation is a dominant feature affecting the European crust in the studied area. The paleomagnetic and AMS studies of syn-extensional crustal magmatism demonstrate that this extension is associated with anticlockwise rotation and south-eastward tilting of blocks related to Carboniferous rotation of extensional stress direction.