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From the Orogens of Europe to the Origin of the Arctic

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At the International Geological Congress in 1984 in Moscow, a new International Lithosphere Programme initiative, concerned with the origin and dynamic evolution of continents, was launched. It was named EUROPROBE and focused on the tectonic evolution of European lithosphere and its interaction with the deeper mantle. Close integration of geological, geophysical and geochemical research was required, together with participation of the entire European solid earth science community..

The programme lay dormant for a few years, waiting for "*glasnost & perestrojka*" to open the door to comprehensive East - Central - West European collaboration, but in the late 1980's it took off, modified its original ambition (a single E-W transect) to concern the whole of Europe in time as well as space, and engaged the interests of hundreds of geoscientists from over thirty countries. EUROPROBE concentrated its research to the tectonic evolution of key segments of the European crust, several of them orogens, Archean to Alpine, but including important extensional phenomena such as the intra-cratonic rifting of the Dnepr-Donetz Pripyat' aulacogen.

With a decade of support from the European Science Foundation, starting in the early 1990's, EUROPROBE's scientists succeeded in integrating European geoscience to a unprecedented degree. Knowledge of the Carpathians and Panonnian Basin, the Variscides of Central Europe and Iberia, the Uralides separating Europe from Asia, the Timanide Orogen of northeastern Baltica, the Palaeoproterozoic and Archean orogens of proto-Baltica and other features dominating the tectonic evolution of Europe, was much improved (Geol. Soc. London Memoir 32, 2006). Not only was it well established that plate tectonics drove orogeny throughout the Phanerozoic and Precambrian at least into the late Archean; it was also apparent that lithospheric "inheritance" played a remarkably influential role throughout this period, most obviously in the younger evolution of continental crust.

The Timanide Orogen has provided remarkable evidence of the importance of inheritance. With the understanding of the accretionary character of this Neoproterozoic Orogen and its continuation beneath the eastern Barents Shelf, came the recognition of its control over the development of overlying Palaeozoic and Mesozoic basins and thus the generation and concentration of hydrocarbons. The recent identification of a high velocity, gently W-dipping slab in the upper mantle beneath the eastern Barents Sea has added to the evidence for the importance of tectonic "inheritance" and its longevity. Nevertheless inheritance can be an enigmatic player, as witnessed by the opening of the North Atlantic along the axis of the Caledonide Orogen, but orthogonally across the latter in the case of the contemporaneous Eurasian Basin. Of decisive importance was the rheology of the colliding continental lithospheres, the geometry of collision and resulting tectonothermal history. In the former case, orthogonal collision involved deep underthrusting of the Laurentian craton margin by Baltica crystalline basement and widespread eclogitization of the latter. In the case of Eurasian Basin margin, the Caledonian boundary in the Barents Shelf apparently is transcurrent and its influence on the lower crust and upper mantle less profound.