# George R. Tilton and the development of U-Pb geochronology

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In the early decades of U-Pb geochronology, following the discovery of radioactivity and the recognition of the decay products of U decay, ages based on U/Pb ratios were determined using classical chemical methods. As a result, age determinations were limited to U ore minerals containing large amounts of U and Pb. The application of mass spectrometry to U-Pb studies, e.g. Nier [1, 2], was a major advance, but did not change the sample requirements -- the early mass spectrometric methods required several milligrams of Pb per determination.

From the late 1940's to the mid-1950's, George Tilton and his fellow graduate student at the University of Chicago, Clair 'Pat' Patterson completely revolutionized U-Pb geochronology. They developed the clean chemistry, isotope dilution, and thermal ionization mass spectrometry techniques to accurately measure the low concentrations and isotopic compositions of U, Th, and Pb in meteorites [3] and in virtually every mineral in a sample of ca. 1 Ga granite [4]. The new techniques reduced the amounts of Pb required for accurate measurements of concentration and isotopic composition by ca. three orders of magnitude, allowing application of $^{207}Pb/^{206}Pb$ dating to meteorites and the Earth [3], and of U-Pb dating to small amounts of zircon, sphene (titanite), apatite [4] and monazite [5], thus setting the stage for the modern era of U-Pb geochronology.

[1] Nier (1939) *Phys. Rev.* **55**, 150–153. [2] Nier (1939) *Phys. Rev.* **55**, 153–163. [3] Patterson *et al.* (1955) *Science* **121**, 69–75. [4] Tilton *et al.* (1955) *Bull. Geol. Soc. Amer.* **66**, 1131–1148. [5] Tilton & Nicolayson (1956) *Geochim. Cosmochim. Acta* **11**, 28–40.

# Fe –metasomatism in upper mantle beneath SW Poland

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Cenozoic alkaline volcanic rocks from SW Poland make the NE termination of Cenozoic Central European Volcanic Province. The volcanics occur on both sides of the NW-SE trending Intrasudetic Fault Zone (IFZ), a major Variscan dislocation feature separating crustal blocks of different geological record. Two peaks of volcanic activity (30-26 and 23-15 Ma) are recorded in volcanics occurring to the north of IFZ, whereas Cenozoic eruptive rocks located south from the fault zone (Lądek Zdrój volcanic field, Kozákov volcano) are much younger (5 – 3 Ma). All of the mantle xenoliths occurring in alkaline rocks are from the mantle spinel peridotite facies.

The xenoliths occurring in volcanic rocks located N of the IFZ record significant depletion, especially in basaltic components followed by various style of melt-related metasomatism. Significant part of peridotites are enriched in Fe, which is evidenced by low (83-89 %) forsterite content in olivine, and low #mg in orthopyroxene (0.85-0.86) and locally cpx (0.87-0.88). Textures of these peridotites exludes cumulative origin linked to crystal sellting. Some of mineral chemical features (e.g. NiO in Ol 0.30 – 0.44 wt.%) indicate upper mantle origin. We suggest that the Fe – enriched peridotites represent parts of mantle affected by Fe (and Mn) – rich metasomatic agent, which appearts to be alkaline silicate melt in the Księginki locality [1]. Lack of bulk rock Ca enrichment, typical for other Fe – peridotites [2] suggests low fraction of carbonated-eclogite-derived melts [3, 4] to be a metasomatic agent in Krzeniów locality.

The Fe-enriched peridotites among mantle xenoliths have not been found to the south of IFZ (Lądek Zdrój [3], Kozákov [5]). Moreover, xenoliths from the southern and northern domains differ in respect to texture, modal composition and style of metasomatic processes. Hence, we suggest that IFZ constitutes also a boundary between two litospheric mantle domains.

[1] Puziewicz *et al.* (submitted) *J Petrol.* [2] Ionov (2005) *Contr Miner Petr* **150**, 335–353. [3] Dasgupta *et al.* (2006) *J Petrol* **47**, 647–671. [4] Matusiak-Małek *et al.* (2010) *Lithos* **117**, 49–60. [4] Ackerman *et al.* (2008) *J Petrol* **48**, 2235–2260.