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Oklo natural analogue of radioactive waste disposal, summary of European Commission projects' results (1991-1999)

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At the dawn of the 1990s, the question of the feasibility of the geological disposal of radioactive waste became significant. Among the tools for studying this feasibility, natural analogues had a special place, making it possible to obtain both quantitative and qualitative demonstration elements. Among natural analogue, the Oklo site, in Gabon (equatorial Africa), represents a unique geological environment where nuclear reaction products have been naturally introduced and can still be detected in fossil reaction zones.

From 1991 to 1999, two international research projects conducted under the auspices of the European Commission, studied radionuclide mass transfer processes to the surface, focusing on quantitative assessment of radionuclide migration/retention within the Oklo hydrogeological basin. These projects compiled useful information and tools for the safety assessment of radwaste disposal. The most relevant part included new data on the long-term evolution of spent fuel, suggesting the possible occurrence of a coffinitisation process and measurement of short term leaching rates of Oklo uraninite; modelling tools and data to quantitatively describe the interaction of uranium and rare earth elements with a complex clayey material; the demonstration of radionuclide trapping in generic mineral phases such as Mn and Fe oxides, chlorite, illite and specific secondary minerals such as phosphates and Zr-silicates; and a consistent understanding of redox buffering in a clayey environment, from deep to surface conditions, generic enough to be adapted or applied to other sites.