Some Man-Made and Natural Radionuclide profiles in the Bottom Sediments of the Caspian Sea.

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Abstract

The bottom sediments collected in different parts of the Caspian Sea are analyzed for some natural and man-made radionuclides. The vertical profiles of radionuclides vary significantly for samples collected in different parts of the Caspian Sea. The ^{۲۱۰}Pb age-dating was performed for several sediment core samples together with determination of Plutonium isotope ratios that gave the indication of the origin of the radionuclides.

Bottom sediments are scavengers for some Uranium and Thorium chain radionuclides, man-made radionuclides and other pollutants. Historical deposition records could be build up using the radionuclide activities in the bottom sediments. The current knowledge of natural and artificial radionuclides in the vertical profiles of bottom sediments collected in different parts of the Caspian Sea is presented in this review. The atmospheric nuclear tests in ۵۰-۶۰ss and accident at the Chernobyl NPP (۱۹۸۶) are the main sources of man-made radionuclide contamination of the Caspian Sea. The possibility of some impact by the contemporary nuclear activities of European Countries is possible as well. The sediment cores were collected in the Anzali region.

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The ^{210}Pb age-dating and ^{238}Pu/ $^{239, 240}$Pu, ^{241}Pu/ $^{239, 240}$Pu ratios were used to determine the sedimentation rates and origin of the man-made radionuclides.

۱.Input of Man _Made Radionuclides to the Caspian Sea

۱.۱. ATMOSPHERIC NUCLEAR TESTS

The global man *made radionuclide fallouts as a result of the nuclear weapon tests in an atmosphere could be obtained everywhere in bottom sediments estimated the deposition of* Sr^{90} *and* ^{137}Cs.This value for $^{239-240}$Pu was ۸۱،۴ MB q/Km as estimated by Hardly etal. [۳] .The maximum activity of man _made radionuclides in vertical profiles of bottom sediments caused by intensification of the nuclear weapon test is usually observed in the beginning of ۶۰th with the smooth recession after prohibition of the nuclear weapon tests , except for underground tests [۳،۴].

۱.۲. ACCIDENT AT THE CHERNOBYL NPP

The chernobyl accident has resulted in significant pollution of the Caspian Sea by long lived radionuclides in particular ^{137}Cs and ^{90}Sr , During the first month after accident the main part of radionuclides acted to the Caspian Sea with atmospheric fallouts. Later radionuclides mostly were transported by the rivers mainly the Volga. Radionuclides that are less volatile and from soluble species under the environmental conditions (like ^{90}Sr) preferentially were transported by the rivers than by direct fallout unlike ^{137}Cs .

The primary ^{137}Cs atmospheric fallout was governed by the meteorological conditions and occurred extremely non_uniformly on asurface of the sea .During the first days (April ۲۶_۲۸) prevailing direction of a radioactive could transfer was northwest and

as a result the Northern and the Western Europe has undergone to contamination. The next days the direction of the wind has changed on western. At the first days of May , ۱۹۸۶ the local deposition of radionuclides in area of the Caspian Sea coast of the Iran was observed.

The average ^{۱۳۴}Cs / ^{۱۳۷}Cs activity ratio for upper layers of the sediment cores collected in ۱۹۸۷ in the western part of the Caspian Sea was ۰,۰۹ ± ۰,۱۳ but for some ۳۷ samples the average value ۰,۲۲ ± ۰,۱۱ that correspond to the chernobyl origin of this radioniclides [۵].This shows that Cs isotope contamination was not uniform.The average ^{۱۳۷}Cs / ^{۹۰}Sr activity ratio was ۱,۹ ± ۲,۶ with the highest value of ۲.۶± ۳,۰ for ۱۴ samples [۵].

۲.Radionuclides in bottom Sediments of the Caspian Sea

۲.۱ RADIONUCLIDES DISTRIBUTION NEAR THE ANZALI COAST

Two bottom sediment cores were collected near the Anzali coast _ one in the Anzali lagoon and the second one at the Anzali coast

In order to study the origin of the radionuclides the plutonium isotope ratios could be used [۲،۷] .The ^{۲۴۱}Pu with a half _life period of ۱۴,۵ years can serve as sedimentation monitor together with ^{۲۳۸}Pu / $^{۲۳۹،۲۴۰}Pu$ and ^{۲۴۱}pu / $^{۲۳۹،۲۴۰}Pu$ ratios [۱].

The ^{۲۳۸}Pu , $^{۲۳۹،۲۴۰}Pu$ and ^{۲۴۱}Pu and their activity ratios were determined for several horizones of the sediment core samples by semiconductor α _ spectrometry and LSC .

The obtained data provide an indication that sediments are mixed and the radionuclides have both chernobyl and fallout origin .The upper layers were mostly

contaminated with chernobyl plutonium whereas the relative content of fallout radionuclides increased.

Conclusion:

The smooth decrease of ^{۲۱۰}Pb activity with depth was observed for the studied sediment core samples that made possible to age _date this samples .The highest ^{۱۳۷}Cs activity was found in the upper horrizon that correspond to the beginning of ۹۰'s. It could be explained either by ۱۹۹۱ flooding of the territories near the Chernobyl NPP or by the low kinetics of corrosion[۵] of the Chernobyl "hot " particles According to V.Sobotovich and G.Bondarenko [۶] the half _life of destruction of" Chernobyl " hot _particles is ۲,۳ _۵,۸ years.

References

۱. Buesseler ,K .O ., Livingston ,H.D.(۱۹۹۶) Natural and man *made radionuclides in the black Sea in : P.Guegueniat , P.Germain and H.Metiver (eds.) Radionuclides in the oceans .Input and inventories , Les editions de physique ,Les Ulis ,PP.* ۱۹۹۳۷۱.

۲. Juzdan Z.R (۱۹۸۸) Worldwide deposition of ^{۹۰}Sr through ۱۹۸۵.Enviromental Measurements laboratory Report EML ۵۱۵,*Department of Energy , New*York

۳. Harddy E.P Krey P.W and V olchok H (۱۹۷۳) Global inventory and distribution of fallout plutonium , nature ۲۴۱ , ۴۴۴_۴۴۵

٤. Sapozhnikov Yu.A Efimov I.P Sapozhnikova,L.D ,Remaz V.P (۱۹۹۲) Determination of Strontium _ ۹۰ in surface waters of the Black Sea in ۱۹۹۱,Vestnik MGU ser Khimiya ۳۳ , ۴, ۳۹۵ _۳۹۹

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