\textbf{\textsuperscript{129}I present in Bovine Thyroid in Argentina}

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\textbf{Abstract.} \textsuperscript{\textsuperscript{129}}I concentrations in bovine thyroid coming from all over Argentina were analyzed by Accelerator Mass Spectrometry and total iodine present in samples by Gas Chromatography. We present a preliminary latitudinal profile of \textsuperscript{\textsuperscript{129}}I concentrations. Once we complete this study, it will be the first set of data of this kind from an extended region of South America.

\textbf{Keywords:} \textsuperscript{\textsuperscript{129}}I; iodine; bovine thyroid; AMS, Argentina

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\section{1. Introduction}

The \textsuperscript{\textsuperscript{129}}I radioisotope (half-life: 15.7 Ma), has been extensively used as oceanic tracer, as a tracer for several geological and biological processes, and as nuclear-activity monitor in the northern hemisphere. This nuclide has become widely distributed in the global environment from its main sources, nuclear fuel reprocessing plants in France and U. K. and the pre-anthropogenic \textsuperscript{\textsuperscript{129}}I/\textsuperscript{\textsuperscript{127}}I (10^{-13}-10^{-12}) value has increased up to 6 orders of magnitude [1] Given its long half-life and the large distance to the sources, it is expected that the \textsuperscript{129}I behaves in the same way to stable iodine. Up to now, however, there is very scarce information of the South-American subcontinent. Aiming to contribute to the global understanding of the behavior of this isotope, we have started at the TANDAR Laboratory a research program using \textsuperscript{\textsuperscript{129}}I as environmental tracer in Argentina. In particular we study thyroid glands, because they concentrate iodine up to a factor 50, which is mainly acquired by the animal from grass ingestion. We measured bovine thyroids samples taken at different latitudes between 27\textdegree and 52\textdegree South.
Figure 1. Sampling locations for bovine thyroids (open circles). Solid squares represent nuclear power plants locations. Samples come from latitudes between 27º and 52º South.

2. Experimental
The origin of the bovine thyroids samples are shown in Figure 1. By means of a chemical treatment (which partially follows Gu [2] and Marchetti [3]) the iodine is extracted from the thyroids. While a fraction is used to establish the total iodine concentration by means of Gas Chromatography (GC) the rest is homogenized with stable $^{127}$I carrier and then suited for the $^{129}$I/$^{127}$I ratio measurement via the AMS technique. Due to the low amount of $^{129}$I expected in the samples [4] and its long mean life, AMS is the only technique with the necessary sensitivity.

The chemical treatment of the samples was done at the TANDAR laboratory and the AMS measurements were performed at the VERA facility [5]. In these measurements, the $^{127}$I$^+$ beam was measured at a Faraday cup (currents between 0.1-1 μA), whereas the $^{129}$I ions were identified and counted individually by a Time-of-Flight and a Bragg detector.

The yield of the blanks for the chemical treatment (4·10$^{-13}$) were an order of magnitude below the measured ratio for almost all the samples (for two of them, the blank was a factor of two lower)

3. Results and discussion
Since wet-deposition are the main transport mechanism to transport iodine from the oceans (main source) to the pasture fields, and considering that in Argentina (except in Southern-Patagonia region) rains are more often in summer time, it is to be expected a higher environmental level of iodine in summer than in winter time. It has to be pointed that the 2009
winter in Argentina was especially out of rain, mostly in the region where the winter samples came from.

Iodine content in thyroids is modulated by its biological half-life, estimated between 2 and 3 months in humans [6], providing an integrated in time signal, and by seasonal variations, up to a factor 3, due to changes in iodine metabolism and iodine content in animal’s diet [7,8].

Considering the season when the samples were taken, and as part of the data analysis, we grouped them into two sets, one corresponding to those taken in winter time and another one with those taken during summer time. These sets at mid-latitudes, present approximately the same total iodine concentration values (see figure 2). This could be explained with a rise in iodine captation capacity of the thyroid gland during the low-iodine environmental levels (dry season, winter time) Also, there is noticeable correlation of iodine with latitude. That could be understood if we take into account atmospheric global circulation, thus a maximum could be expected in ~30-40° [9]. Iodine concentrations at high latitude could be related with local conditions.

![Figure 2](image-url)

**Figure 2.** Iodine concentration latitudinal profile. Error are in 3-5%.

On the other hand, difference is clear between winter and summer samples in figure 3, where we present preliminary $^{129}$I concentration latitudinal profile. Also in this figure, we can see a dependence with latitude but in this case, the variation between minimum and maximum concentrations is almost 3 orders of magnitude. Comparing the two latitudinal profiles it is easy to recognize that at high latitudes there is a difference in the behaviour of the curves.
The values obtained in this work are similar to ones from locations without direct exposure to the emission from nuclear installations \[9\] and the $^{129}\text{I}/^{127}\text{I}$ ratios are approximately 1-3 orders of magnitude above the pre-nuclear era values.

These results constitute a reference level of $^{129}\text{I}$ in bovine thyroids for Argentina. This set of data could be helpful for determining possible releases of radioactive iodine isotopes from illegal nuclear activities and nuclear facilities.

Further measurements, involving fresh water samples are still in progress.

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