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A particle with one dimension much bigger than the others is defined “fibre”. Many minerals have this kind of habit and are defined “fibrous”. Asbestos is the most known group of fibrous minerals having in common the following chemical and physical characteristics: can be separated into long, thin, strong fibres and have sufficient flexibility to be woven; are heat resistant, chemically inert and electrical insulators (Veblen & Wylie, 1993).

According to International laws the asbestos are: actinolite, amosite, anthophyllite, crocidolite, tremolite and chrysotile (the first fives belong to the amphibole group, the last one belongs to the serpentine group). Amosite, chrysotile and crocidolite, have been used to manufacture a number of industrial products (i.e. building materials, heat and noise insulators); anthophyllite, tremolite and actinolite are less used but they are often present as contaminants in mining areas.

Fibres are continuously airborne so that low levels of asbestos are present everywhere and can be inhaled. These fibres, deposited in the deepest parts of lung, are removed slowly; some of them may reach other organs moving through the lung wall; sometimes are removed via faeces or urine. During last century asbestos has been used in many Western countries. In that time people has undergone the most intense exposition to asbestos fibres. A correlation between exposure and some pathologies, like asbestosis and mesothelioma, has been found for occupational exposure to high levels of fibre content. Because of this reasons asbestos has been banned by many Western countries.

Other non-asbestos minerals can crystallize with fibrous habit (Skinner et al. 1988) and be present in rocks asbestos is exploited (like serpentinites in Piedmont); in fact, ten different fibrous species have been found in serpentinite rocks in the Western Alps: chrysotile, antigorite, tremolite, diopside, carlosturanite, olivine, balangeroite, sepiolite, brugnatellite and brucite.

Chrysotile and tremolite are asbestos (Belluso et al., 1994; Belluso et al., 1997). Chrysotile, antigorite, tremolite and diopside are widely diffused while the others have not a homogeneous distribution; almost all species show submicron intergrowths.

Epidemiological evidences of excess of mesothelioma have been associated sometimes to non-asbestos fibrous minerals also for low exposure levels.

Two important cases occur in Turkey and in Italy. In the Cappadocia area (Turkey) a correlation between excess of mesothelioma and presence of erionite (a natural zeolite) has been found; in the South-East of Sicily (Italy) there is a similar situation, but in this case mesothelioma has been correlated with a new mineral, the fluoro-edenite. In both cases the rocks were occasionally ground and used to produce stucco and whitewashes for buildings (Rohl et al., 1982; Paoletti et al., 2000).

Considering the widespread of manufactures containing asbestos and the presence of non-asbestos fibres in nature, many people are currently environmentally exposed. So far it is impossible to define a threshold of risk, under which the potential toxicity of asbestos is null.

This research aimed to assess the natural environmental exposure to fibrous minerals. This aim has been achieved bydetermining types and quantities of inorganic fibres in different biological and airborne samples, taken from areas having outcropping rocks bearing mineral fibres. To reach our purpose the following aspects have been investigated:

- · typology and amounts of airborne fibres;
- · type and number of fibres carried by recent airborne (up to some months before sampling);
- · mineral burden in animals and humans with environmental exposure.

Two Piedmont valleys have been studied; the natural presence of asbestos and fibrous minerals is their common characteristic. The obtained data, if compared with geological-environmental information, could be used to assess the health risk for population to natural asbestos.

This research is part of a larger interdisciplinary project which aims to assess the asbestos risk from an environmentalhealth side, but also from geological, chemical and biotechnological

TYPOLOGY OF SAMPLES

Lung tissues of cattle

39 cattle samples have been collected: 20 from Susa Valley and 19 from Lanzo Valleys. For each sample the following examinations have been carried out: a) histological analyses; b) counting of ferruginous bodies by MO; c) counting and identification of inorganic fibres by SEM-EDS.

Lung tissues of humans

15 human lung samples (embedded in paraffin): 10 from Susa Valley and 5 from Lanzo Valleys. For each sample the same examinations of cattle samples have been carried out.

Urines of humans

18 human urine samples have been collected: 8 from Susa Valley and 10 from Lanzo Valleys. For each sample the counting and identification of inorganic fibres by SEM-EDS have been carried out.

Airborne

17 spot sampling (9 in Susa Valley and 8 in Lanzo Valleys) and 8 long term sampling (3 in Susa Valleys and 5 in Lanzo Valleys) have been carried out. The filters obtained from both sampling methods have been examined by SEM-EDS in order to identify and quantify asbestos fibres.

METHODS AND TECHNIQUES OF INVESTIGATION

The histological sections have been prepared by the steps reported in Dore (1993) and examined by OM in order toverify the presence of lung pathologies; for the exam of asbestos bodies by OM the procedure described in Churg (1998) has been followed. To identify and quantify inorganic fibres in biological samples and in air the methods reported in De Vuyst et al. (1998) and in D.M. 6 September 1994 (Italian law) has been used respectively.

CONCLUSIONS

Comparing the data from Susa and Lanzo Valleys for each kind of samples the following conclusions can be drawn.

Cattle lung

- · Asbestos Bodies have been found in few samples and in low concentrations;
- · On average the total of fibres found is similar;
- · Tremolite and actinolite are the most frequent asbestos and have been found in similar amounts;
- · It seems that for values above about 80.000 ff/gdw the clearance mechanisms seem to be less effective;

that results in an increasing concentration of fibres with age

Humans lung

- · Asbestos Bodies and fibrous specie have been found in quite different concentration. In fact both AB

and fibres are in much higher concentrations in samples from Susa Valley;

- · Tremolite and actinolite are the most frequent asbestos found

Humans urine

- · the average the total fibres concentration is quite different;
- · Asbestos fibres (tremolite) have been found in only two samples from Susa Valley.

Spot airborne samples

- · The average total fibres concentration is quite similar;
- · Asbestos fibres have been found in both valleys: tremolite and actinolite in Susa Valleys and tremolite and crocidolite in Lanzo Valleys respectively.

Long term airborne samples

- · Asbestos fibres have been found in both valleys: tremolite and crocidolite in Susa Valleys and tremolite Lanzo Valleys respectively.

General conclusions

The presence of asbestos and inorganic fibres in sentinel animals can give information about “environmental background”, term used to indicate the average level of airborne fibres, according to the topographic, geological, and anthropic characteristics in specific areas. In this way it is possible distinguish between environmental background from

natural and anthropic sources.

For this purpose the following conclusions are drawn.

- · The sentinel animals are a good model to assess breathable environmental background because it is

possible to eliminate some variables, such as unknown occupational exposure;

- · Comparison between concentration of fibres and age of animals suggests two clearance thresholds: 80.000 ff/gdw considering all inorganic specie and 40.000 ff/gdw considering only the more frequent species (tremolite, actinolite, chrysotile, antigorite) respectively.

- · The concentration of asbestos fibres (from natural source) in animals coming from area having serpentinite outcropping rocks, as Susa and Lanzo Valleys, is much more higher than the concentration of the same minerals in animals coming from a case-control area of Asti (Piedmont), i.e. an area without outcropping serpentinite.
- · From spot airborne sampling the environmental background for asbestos is very low;
- · The presence of asbestos fibres from natural source in human urine (tremolite) confirms this kind of samples as biological indicator of recent exposure, and consequently of breathable environmental background.

The comparison between average concentration of asbestos from natural source in animals from Susa and Lanzo Valleys and the same data reported in literature (Dumortier et al. 2002) from animals lived in Corsica allows the following consideration.

- · The average concentration of asbestos from natural source in animals from Corsica is much higher than in animals from upper Susa Valley and from lower Lanzo valleys. The same is valid comparing the ranges.
- · The average concentration of asbestos from natural source in animals from Corsica is similar to that in animals from lower Susa Valleys and upper Lanzo Valleys.
- · The higher concentration of asbestos fibres in cattle from lower Susa Valleys and upper Lanzo Valleys correlates with the higher quantities of serpentinite outcropping.

The comparison between the concentration of asbestos tremolite (from natural source) in human lungs from Susa and Lanzo Valleys and that reported in literature for cases of mesothelioma (Churg, 1998), shows levels of exposure for Piedmont valleys much lower than those reported for the mentioned cases of mesothelioma.