WHITE PAPER:

CLINOPTILOLITE ZEOLITE & THE SCIENCE AND RESEARCH OF PURE BODY

About The White Paper:

The information presented in this paper is intended for professional education and is sourced from published research, articles, and books. This paper is not intended to serve as the basis for health advice, and should not be considered to replace the care of a licensed health professional.

Zeolites:

Zeolites are natural minerals of volcanic origin that are characterized as crystalline hydrated aluminosilicates of alkali and alkaline earth cations having an infinite and open three-dimensional structure (Fig. 1).

Zeolite forms when molten volcanic lava meets seawater. Due to the unique conditions that occur at that moment, zeolite forms small cages, becomes very porous, and takes on its unique charge both within the cage and on the surface. The charge occurs when the minerals present in the seawater lock into the structure, and the transformation from molten rock to beneficial mineral takes place.

The ability of zeolites to lose and gain water reversibly and to exchange extra-framework cations, both without change to the crystalline structure, is the basis of their unique properties as "molecular sieves."

Zeolites exhibit versatile adsorptive, cation-exchanging, dehydrating-rehydrating, and catalytic properties that make them suitable for multiple uses. Simplified, this means that zeolite looks like a honeycomb and carries a charge that allows it to capture toxins. When ingested, powdered zeolites, like almost all silicates, are inert and therefore do not react chemically with food or body fluids or their metabolites. The risk of any associated adverse effects is therefore insignificant. In toxicology studies involving mice and rats, the administration of the zeolite clinoptilolite during a period between 6 and 12 months caused no changes that could be considered a toxic effect of treatment.[2]

A BRIEF HISTORY OF ZEOLITE:

B.C.:	Used in Roman Aqua Ducts
1760's:	Rediscovered by a Swedish mineralogist
1960's:	Mentioned in scientific circles in Europe and U.S.
1970's:	Used for wastewater ammonia removal
1980's:	Used to clarify pool water in Europe and then in USA; used in Chernobyl radioactivity removal
1990's:	Used in agriculture and with cattle and poultry and began to be sold as a supplement for detoxifying the human body
2000's:	Many companies are now marketing clinoptilolite zeolite in numerous products

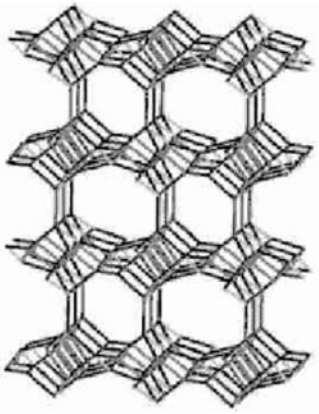

Fig. 1. Crystal structure of the zeolite clinoptilolite with its 8-ring and 10-ring channels.

After the knowledge of zeolite was lost to mankind with the demise of the Roman empire, zeolites were rediscovered and described in 1756 by Cronstedt, a Swedish mineralogist who coined the name from two Greek words meaning 'boiling stones', referring to the evolution of steam when the rock is heated.

About fifty different natural zeolites are now known and more than one hundred and fifty have been synthesized for specific applications such as industrial catalysis or as detergent builders. Needless to say, people have been using zeolite for a very long time.

Health Benefits And Uses Of Zeolite:

Zeolites have been investigated in a broad spectrum of medical uses. Several of these applications take advantage of the adsorption and ion exchange properties of zeolites.

- Recently, two clinical studies involving healthy volunteers and patients suffering from malignant disease and diabetes demonstrated that orally administered natural clinoptilolite is a potent antioxidant.[10]

- When applied externally in powder form, zeolite has also been found to quicken the healing of wounds and surgical incisions; in Cuba, clinoptilolite is commonly used to treat topical wounds in horses and livestock.

- As proven bactericides and fungicides, zeolites have been used to control urinary tract infection and dental plaque formation.[11-13]

- It is well known that silica particles prevent almost completely the onset of spontaneous diabetes in young BB rats and the destruction of β cells in non-obese mice given cyclophosphamide.[14, 15]

- In mice with alloxan-induced diabetes, natural clinoptilolite has been shown to avert or diminish some late sequelae of the disorder, such as polyneuropathy.[2]

- Accumulating evidence has suggested that zeolites may significantly affect the regulation of the immune system.

  Ueki et al have reported that silica, silicates, and aluminosilicates may act as nonspecific immunostimulators in a manner similar to that of the superantigens (SAgs),[16, 17] a class of powerful, immunostimulatory bacterial and viral toxins. Unlike conventional antigens, SAgs bind as unprocessed proteins to particular motifs of the variable region of the β chain (Vβ) of the T-cell receptor (TcR) outside the antigen-binding groove and to invariant regions of major histocompatibility complex (MHC) class II molecules on the surface of antigen-presenting cells (APCs).

  As a consequence, SAgs, in nanogram to picogram concentrations, stimulate up to 10% to 30% of the host T-cell repertoire, whereas in conventional antigenic peptide-TcR binding, only 1 in 10^5 to 10^6 T cells (0.01%-0.0001%) is activated. [18] In accordance with this theory, proinflammatory macrophages, which belong to MHC class II APCs, are activated by fibrogenic silicate particles,[19, 20] and the removal of MHC class II DP/DR+ cells results in a lack of macrophage stimulation by the silicate chrysotile.[16]

  More recently, Pavelic et al have demonstrated that the lymphocytes from lymph nodes of mice that were fed for 28 days with micronized zeolite clinoptilolite provoked a significantly higher allogeneic graft-versus-host reaction than did lymphocytes in control mice. After the mice were administered clinoptilolite intraperitoneally, the number of peritoneal macrophages increased significantly, as did their superoxide anion production. [21]

- The property of clinoptilolite to remove heavy metals has been documented extensively [16 21].

The Mechanism Of Action Of Clinoptilolite Zeolite:

Clinoptilolite has a cage-like structure, with pores and channels running through the crystal. The cage and surrounding mineral carries a net negative charge, making it one of the few negatively charged minerals found in nature.

Because of its cage-like structure and negative charge, clinoptilolite has the ability to draw and trap within and on itself [10,19] positively charged heavy metals and other toxic substances [2,4,9,11,13,18,20,23,32,33.]

The zeolite in Pure Body attracts and traps small, highly-charged particles that fit into the pores and channels of the zeolite cage. The SiO4 units are electrically neutral, but each AlO4 unit carries a negative charge, creating fixed, negatively charged sites throughout the crystal structure.

The negative charges of the AlO4 units are balanced by the presence of four-exchangeable, positively charged metals known as cations. These cations usually consist of calcium, magnesium, sodium and potassium. These ions are only loosely held and can be readily displaced by other substances, such as toxic heavy metals or other organics. This phenomenon is known as cationic exchange, and it is the very high cationic exchange capacity of zeolites, which provides for many of their useful properties.

In their chemical makeup, zeolites are made up of aluminum, silica, and oxygen. Zeolites have a rigid, 3-dimensional crystalline structure (similar to a honeycomb) consisting of a network of interconnected tunnels and cages. Water moves freely in and out of these pores but the zeolites framework remains rigid.

Another special aspect of this structure is that the pore and channel sizes are nearly uniform, allowing the crystal to act as a molecular sieve. Whereas most chelating agents used for detoxification are non-specific, only relying on charge for binding potential, the clinoptilolite seems to be highly specific for the heavy metals.

Research has shown that the smaller the diameter of the metal and the higher the charge of the metal, the greater the affinity it has for the zeolite. Higher charges simply increase the strength of binding with higher binding characteristics. The small size allows for deeper access into the zeolite pores with more points of coordination (attachment).

As an example of this phenomenon, arsenic has a charge of +3 and an atomic radius of approximately 1.8 angstroms, while potassium has a charge of only +1 and an atomic radius of approximately 2.8 angstroms. The arsenic binds with very high affinity for the zeolite while the potassium has no affinity whatsoever.

The clinoptilolite binds a variety of toxins. This includes heavy metals (Lead, Cadmium, Mercury, etc.), nitrosamines, and others. Cationic exchange is an entirely passive process: when the zeolite is in close proximity to these high-affinity compounds, they will be drawn to the zeolite and either absorbed into the cage or adsorbed onto the surface of the zeolite. There is no chemical activity in this process.

The zeolite will not be drawn to compounds in an effort to ‘rip’ metals away from them. In other words, the zeolite will not pull metals that are sequestered inside tissue or bone. If, on the other hand, the tissue has already released free metals into the system, the zeolite will have the ability to trap and remove it.

Organics (Non Volatile and Volatile) are also removed by Clinoptilolite.[3,4,5,9,11,17,18,20,32] Organics are not trapped or exchanged in or onto the surface as in heavy metals, but rather are absorbed into and onto the clinoptilolite using a combination of ionic attraction rather than exchange.

This attraction is based on the overall charge of the organic compound with preference given to positive charge points on the molecule itself. Thus, a large molecule such as ammonium citrate will still be removed even though its size is much larger than the particle of zeolite. There are many studies ongoing today to take advantage of this effect (see references 34 to 42 below).

While clinoptilolite is mostly known for heavy metal removal, the ability to positively affect the removal of potentially toxic organic compounds at the same time cannot be ignored.

Environmental Exposure To Heavy Metals And Toxins:

In our increasingly industrialized world, the issue of toxic environmental exposure is coming to the forefront as an issue of public health and safety.

In 2009 the **Fourth National Report on Human Exposure to Environmental Chemicals** (prepared jointly by the Department of Health and Human Services, Centers for Disease Control and Prevention, and the National Center for Environmental Health, updated 2011) gives a comprehensive look at what the human exposure is in a cross section of Americans. Quoting from the report:

> "The Fourth Report presents data that provides estimates of exposure for the civilian, non-institutionalized U.S. population. The Fourth Report, for the first time, provides population reference values in blood and urine, including 95th percentile levels, for 75 chemicals."

This report shows that mercury increases over our lifetime from an average of .6 ug/L (micrograms per liter) at age 16 to over 1.2 ug/L at age 40. The trend continues as we age. Again quoting directly from the report:

> "Blood and urine are commonly used to measure recent exposure to mercury. Hair is a biomarker of long-term exposure to methylmercury. CDC's first National Exposure Report (2001) reported geometric means of mercury in blood of 0.3 µg/L for children ages 1- 5 years and 1.2 µg/L for women ages 16-49 years. However, 10% of the women tested by CDC were found to have mercury levels that exceeded the level defined by a National Research Council expert committee to be optimally protective for the developing fetus."

This study shows that the average from 2001 to 2011 has risen from 0.3 ug/L to 0.6 ug/L. Also,

> "New data on blood lead levels in children aged 1 to 5 years enable estimates of the number of children with elevated levels (that is, levels greater than or equal to 10 micrograms per deciliter [µg/dL]) to be at 1.4% of children between 1 and 5."

To put this in perspective, the current USA population is over 311 million people (311,800,000 in mid-2011 (US Census Bureau)). There are 19,176,000 children under the age of five. The CDC considers children to have an elevated level of lead if the amount in the blood is 10 micrograms per deciliter (µg/dL) or higher. However, recent information suggests that effects on the nervous system and developmental effects in children can occur at blood lead levels as low as 2.5 µg/dL. CDC's first National Exposure Report (2001) reported geometric mean blood lead levels of 2.0 µg/dL in children ages 1-5 years, and 1.6 µg/dL for all age groups.

Those 268,464 (1.4%) children under the age of five may be neurologically impacted due to lead alone. The geometric mean of urine lead concentration across all age groups was 0.80 µg/L. The number of adults with high levels of lead is in the millions.

Quoted from the Fourth Report: Sources of Heavy Metals and Routes of Exposure:

> "Heavy metals have been widely used in industry since the 1800's and as a result are common environmental contaminants. Sources of heavy metals include air emissions from coal-burning plants, smelters, and other industrial facilities (e.g., cadmium and arsenic); waste incinerators (mercury and cadmium); process wastes from mining and industry; pesticides and wood preservatives (e.g., arsenic and chromium); fertilizers (e.g., cadmium is found in phosphate fertilizers); and lead in household plumbing and old house paints. While certain types of industrial facilities are required by the EPA to report their releases of some heavy metals to the Toxics Release Inventory (TRI), other major sources, including power plants and waste incinerators, are not. Consequently, the TRI may significantly under-report actual environmental releases of some metals.
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> Heavy metals can also enter the environment through natural processes. For example, in some parts of the U.S., naturally occurring geologic deposits of arsenic dissolve into groundwater, potentially resulting in unsafe levels in drinking water supplies. Once released to the environment, metals can remain for decades or centuries, increasing the likelihood of human exposure. Humans are exposed to heavy metals through inhalation of air pollutants, consumption of contaminated drinking water, exposure to contaminated soils or industrial waste, or consumption of contaminated food. Food sources such as vegetables, grains, fruits, fish, and shellfish can become contaminated by accumulating metals from surrounding soil and water.
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> **Health Effects of Heavy Metals:** Heavy metals cause serious health effects, including reduced growth and development, cancer, organ damage, nervous system damage, and in extreme cases, death. Exposure to some metals, such as mercury and lead, may also cause development of autoimmunity, in which a person's immune system attacks its own cells. This can lead to joint diseases, such as rheumatoid arthritis, and diseases of the kidneys, circulatory system, and nervous system.
>
> Metals are particularly toxic to the sensitive rapidly developing systems of the fetus, infants, and young children. Some metals, such as lead and mercury, easily cross the placenta and can damage the fetal brain. Childhood exposure to some metals can result in learning difficulties, memory impairment, damage to the nervous system, and behavioral problems such as aggressiveness and hyperactivity. At higher doses, heavy metals can cause irreversible brain damage. Children may receive higher doses of metals from food than adults may, since they consume more food for their body weight than adults do. In addition, children absorb metals more readily through their intestinal tract than adults."

Then there are the other heavy metals such as Cadmium, Antimony and Beryllium. The list goes on. All are valuable metals used in many modern products and processes. Many are by-products of energy production including the common fuels, gasoline, and coal. Using studies such as the Fourth Report, the need for heavy metals and organic compound removal from our bodies is evident.

Given the scope of the problem in the United States, it is logical to assume that any industrial nation has similar issues with heavy metal environmental toxins. These toxins do not respect national borders so those countries with developing neighbors have increased risk of exposure as well.

As previously stated and referenced, the zeolite clinoptilolite is widely known for heavy metal removal.

Determining Factors Of An Effective Clinoptilolite Supplement:

Clinoptilolite zeolite is shown in numerous studies to remove heavy metals and toxins at a cost effective level, without side effects.[1]

However, there are frequently lax standards when it comes to production of clinoptilolite supplements. There are several manufacturers of clinoptilolite products, all claiming that their product is the best. Upon investigation, these companies have little to no science behind the formulation of their product, no published testing or proof of what is actually in their product, and written materials that are copied verbatim from other companies.

Factors that consumers should evaluate in determining what comprises an effective clinoptilolite zeolite supplement include:

1. Source:

- The clinoptilolite zeolite in Pure Body comes from a well-known US source. Thus the way the material is handled from the time of mining to the final bottling step is regulated under US laws and standards of quality.
- Because of this internal US source, there are zero questions of fair labor or safe labor practices, unknown contaminates due to non-regulation of industrial pollutants, unknown contaminates being introduced from cross contamination (equipment being used for other uses other than handling zeolite) etc.

2. Verification:

- Touchstone uses an independent laboratory to test every batch of Pure Body. This is done to ensure that the product is both processed properly and is safe to use. The certified laboratory tests for everything from heavy metals to organic compounds to microbial assays to the size of the individual particles.
- In addition, every raw material shipment is checked for exactly the same things as the finished product. While the manufacturing process has GMP certified protocols in place to check quality standards every step of the way, Touchstone feels the added step of independent analysis is in the best interest of the consumer. Everyone deserves verified assurances of what you are ingesting for your health.

WHAT DOES GMP CERTIFIED MEAN?

GMP means Good Manufacturing Practices and is a mark that can commonly be found alongside of NSF certifications. This is a term that is used around the world and signifies that product has been tested for quality control. GMP also regulates the equipment used to create each product and requires that all methods of operation, which includes: cleaning, testing and manufacturing have been validated to perform their specific function. In short GMP and NSF certifications mean that you are getting a safe and consistent product each time that you buy it. With ongoing NSF and GMP processes, the same high standard is applied to the product whether you purchase today or three years later. It will always be the same product manufactured with the same high standards.

3. Particle Size:

- Size does matter when ingesting zeolite. Touchstone's Pure Body is put through a proprietary milling system that does two very important things. The first is to take the zeolite down to 0.3 micron mean average. This means that the vast majority of zeolite particles are going to be in the 0.1 to 0.5 micron window that the body uses the best. Will there be particles larger than 0.3 micron, Yes. Those larger particles will proceed to the large intestine, where they can trap toxins in the colon.

- The second thing our proprietary milling system does is to reduce the size of the particles down to a 0.3 micron mean average without crushing the zeolite cages which do all the work. Conventional methods used in most other zeolite preparations, is the utilization of a hard material such as a roller or steel balls to crush the zeolite to size. This method—while cost effective—destroys the very mechanism of why zeolites work in the first place, the cages, and their negative charge. The preparations for Pure Body do not use a mechanical crushing system to reduce the material to size thus keeping the cages intact.

Why Size Matters For Zeolite Surface Area And Uptake Into The Bloodstream:

1. Zeolite works exactly like a sponge. If you look at a sponge, you will see all the little cells (cages) that allow the sponge to soak up water. Suppose you cut the sponge in half. Now you have doubled the number of cells that are available to soak up water, cut the two pieces in half again and you have quadrupled the number of exposed cells.

   If your zeolite particle is too large, there simply is not the number of exposed cages to be as effective as Pure Body. Reducing the size of the zeolite particle down to a true 0.3 micron mean average gives you a much larger surface area and exposed cages to remove the toxins from your system.

2. The reality is that anything larger than 0.3 micron will not enter the bloodstream. If the zeolite can't enter the bloodstream then it has to stay in the colon where it is limited to the exposure to toxins for removal. Our bodies are extremely efficient at storing toxins in the fatty tissues of our bodies. Any toxin the body does not recognize or does not have an enzyme to break down gets stored

   The only way toxins are safely removed from these fatty tissues is to insure that the zeolite can reach it via the blood stream. Zeolite does not hunt down toxins and heavy metals. The zeolite has to come into physical contact with the toxins and heavy metals for the ion exchange to take place and the material trapped inside the zeolite.

   Remember that we are talking about mean averages here. There will be some particles that will enter the colon to help it cleanse as well. Then due to the unique nature of zeolite, all of the particles will be safely eliminated from the body.

4. Science:

The question is often asked if there is real science behind using clinoptilolite zeolite as a health product. The answer is a resounding yes! At the end of this white paper you will find a list of research papers that detail the benefits of using zeolite.

These peer-reviewed papers have withstood the test of independent scrutiny and both clinical and in vitro studies. The science of zeolite has produced a multibillion dollar industry and worldwide trade in zeolite. It has proven to be effective in multiple studies and is continuing to be studied today.

Summary:

1. Clinoptilolite zeolite is safe and effective, proven in numerous trials involving both people and animals.

2. **Pure Body** is the only product that chooses to use a truly independent lab for testing product purity.

3. Touchstone Essentials checks the purity of each batch of product for purity with an independent lab versus an in-house manufacturing lab. Other manufacturers do not check purity at all, or use an in-house lab—which can lead to a perception of bias—or do a statistical check not a real time check (check one out of 'x' number of batches).

4. Safety and effectiveness of **Pure Body** is instilled through the stringent protocols from testing the incoming raw material to knowing what is in every bottle of product that reaches the consumer.

5. The federal guidelines set a maximum of three (3) grams per month as a maximum dosage. **Pure Body** is the only product that can prove the maximum allowed by regulation of actual Zeolite.

6. There are no financial or fiducially legal interactions between Touchstone Essentials and the Manufacturer and Independent Laboratory. Both are truly independent. There can be no perception of bias.

7. The integrity of Touchstone Essentials to bring the very best product to market is translated to the consumer through the commitment to continue to research and improve the product based on science.

8. Having GRAS (Generally Recognized As Safe) status with the FDA for clinoptilolite is assurance of the effectiveness and safety of **Pure Body.**

9. **Pure Body** is safer and much more economical than the alternatives available to remove the environmental toxins we are exposed to every day.

While all of the above cost Touchstone Essentials more to produce Pure Body, of greater importance is public safety and trust. The benefits of clinoptilolite zeolite in removing heavy metals, with the added benefits of proven removal of some organic toxins, makes the choice of Pure Body an economical and safe addition to everyone's lifestyle.

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