Deepening Cosmic Education

by Gerard Leonard

This article is a special blend of research, theory, and practice, with clear insight into the origins of Cosmic Education and cosmic task, while recalling memories of student explorations in botany, in particular, episodes from Mr. Leonard's teaching. Mr. Leonard speaks of a storytelling curriculum that eloquently puts perspective into dimensions of Cosmic Education as philosophy, human unity, heroes of history, invention, gratitude, connections with nature, and much more.

It is 1946 in Karachi, and a simple but profound story is being told. A little child did not have a pencil to write with, so his teacher sent him to the store to buy a pencil. When he got there he had to wait a long time in line before he could purchase his new pencil. When he arrived back at school he complained about having to wait so long. A wise elder lady happened to be nearby and heard this. She beckoned him to her and told him a story—the fascinating journey of this pencil and the many, many people who had taken part in the pencil's trip and had worked to bring it to him. She spoke of the graphite and the wood and how they had been formed and where they came from. She spoke of the miners, woodworkers, transporters, and many others who had been part of making this pencil.

She also spoke of the lady shopkeeper and of how hard she worked to make a living and serve the people by selling the items they needed. She strove to awaken compassion, to open up the child's imagination and inspire his intelligence to see farther and deeper, one could even say to see through the surface of things, in order to perceive in this simple tool—the pencil—a sense of the whole and the interconnections between things and people. The elder hoped to awaken gratitude and invoke patience as a respectful response to another's noble labor.

That wise elder was Dr. Maria Montessori. She told this story to her trainees in Karachi.[1] She was illustrating how a Montessori teacher whose mind and heart were prepared could take a small detail and open up the cosmic vision to a child.

Vladimir Nabokov speaks of the nature of this kind of "act of attention" in his book *Transparent Things.* One object of attention he speaks of is "a very plain, round, technically faceless old pencil of cheap pine. . . . When we concentrate on a material object, whatever its situation," he says, "the very act of attention may lead to our involuntarily sinking into the history of that object. Transparent things, through which the past shines!" (1, 6).

For Dr. Maria Montessori, the sinking into the deep history and cosmic function of the object was not quite so involuntary. She had been practicing this mode of thinking for some time and had been presenting her ideas on Cosmic Education since the mid-1930s. Her years in India (since 1939) had enlarged her understanding of the cosmic theory she had first encountered in the brilliant writings of her famous Italian forebear, the geologist Antonio Stoppani. Stoppani's book *Acqua ed aria* was the major influence on her expansive and deep understanding of the idea of cosmic task.[2] She developed this concept of the cosmic task of living creatures and elements and its role in the education of young people in her lectures throughout the 1940s and particularly in her books *To Educate the Human Potential* and *From Childhood to Adolescence* and in several lectures and articles, including "The Unconscious in History." In a 1940 lecture, she quotes the following key statement from Stoppani's book *Acqua ed aria:* "To the animals which live on the globe, a task has been given from the very beginning of the world, to maintain this world. And that organization, which ensures the purity of the sea-water and the purity of the air during the many millions of years is called

[1] Ms. Lakshmi Kripalani, one of those Karachi trainees in 1946, told the story to me in the spring of 2005.

[2] Dr. Montessori notes in a lecture given in India that what she came to call "Cosmic Task" should more accurately be called "The Telluric Economy," from the Latin tellus, "earth" (*Creative Development in the Child* 177).

life" (from the chapter "Life as a Telluric Force," page 75, cited in Montessori, Maria, Unpublished lecture, January 29, 1940).

She was convinced that the geological interpretation of Stoppani was an advance on the biological interpretation of evolution, in that the former saw life as part of an evolving Earth and in fact essential to Earth's equilibrium rather than seeing life as simply adapting to a changing environment. By the 1940s this perspective on geological evolution had received new vigor through the work of the Russian geochemist Vladimir Vernadsky. The conception of the biosphere as mentioned in Dr. Montessori's writings is certainly understood by her as what Vernadsky would term "the global dynamic system transforming our planet since the beginning of geological time" (25).

Montessori describes the biosphere as "part of the earth's body [and] like an animal's fur [it] is essentially one with it, its function is to grow with it, not only for itself, but for earth's upkeep and transformation" (*To Educate the Human Potential* 29).

If we are to deeply understand Maria Montessori's Cosmic Education, we have to return to its roots in Stoppani's work. She saw in his vision an enormously all-encompassing way of looking at our Earth's history and our human place as part of the biosphere. She also saw that this approach opened up the intriguing question of the significance of human activity on the Earth.

Antonio Stoppani looked at the Earth from the perspective of what would now be called biogeochemical cycles. He described how life organized the elements and recycled them in a way that actually created the biosphere and in doing so modified the hydrosphere, lithosphere, and atmosphere in order to maintain equilibrium and keep these spheres as media for the transmission of the precious life-supporting elements. These are principally, he says, hydrogen, oxygen, carbon, and nitrogen, in addition to some others.[3] His was a vast geological perspective on evolution and planetary equilibrium. It was Stoppani's writings that opened Montessori's mind to the enormous work of the corals and shelled creatures, to the work of water on a grand scale and to the function of tiny bacteria such as "the ferruginous microbe," *Gallionella ferruginea*, and its amazing role in oxidizing and fixing iron deposits.

Elementary students sketching from nature, Amsterdamsche Montessori School, 1930s

Dr. Montessori respectfully calls this bacterium "a humble worker in earth's laboratory" (*To Educate the Human Potential* 31; see also Stoppani, *Acqua ed aria* 519).

Stoppani described human energy as "a new telluric force on the planet," such is the power of the human to transform the environment (*Corso di geologica*, cited in Clark, Crutzen, & Schellnhuber 2). This human power to transform the planet geologically in terms of her biogeochemical cycles has escalated enormously over the past 130 years. For example, "more nitrogen is now fixed synthetically and applied as fertilizers in agriculture than is fixed naturally in all terrestrial ecosystems . . . and the release of sulfur dioxide to the atmosphere by coal and oil burning is at least two times larger than the sum of all natural emissions" (Clark, Crutzen, & Schellnhuber 4).

In 2001, delegates from over one hundred countries formed "The Earth System Partnership" and inaugurated what some scientists are now calling "The Second Copernican Revolution." It is the revolution in thinking that both Stoppani and Montessori would have wished for, that humans would develop a thorough and continuing scientific understanding of the complex planetary systems. In 2004, the world

[3] In fact, in *From Childhood to Adolescence*, Montessori calls these four elements "The Key to the Universe" (68).

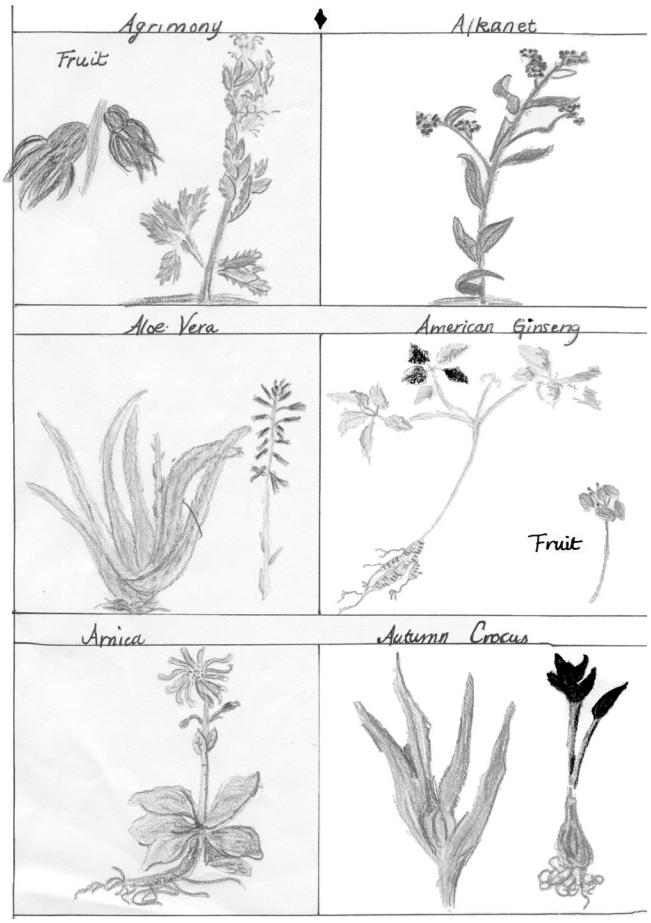
scientific community completed an extraordinary decade-long research titled "Global Environmental Change and the Earth System." Hundreds of researchers collaborated and there is no question in their minds that humans are now a powerful new geological force transforming the planet rapidly (See Clark, Crutzen, & Schellnhuber).

Dr. Montessori's many decades traveling all over the globe deepened her conviction that all life was passionate for work—each to do its specific work—driven to do that work ceaselessly, and if viewed from the vast perspective of geological time, could be understood as contributing to the maintenance of the whole of the biosphere. Observing normal children at work only solidified this conviction. She saw that children given the liberty to follow natural urges wanted to work tirelessly. Seen in the context of the cosmic theory this made absolute sense to Montessori. She observed: "The 'work' goes beyond all needs of the child himself, and it reminds us of these other creatures we have already mentioned whose 'work' exceeds their needs [i.e., the corals]. This need for a similar reorientation with regard to 'work' has been pointed out to us by the child," Montessori says, "so he has indeed taught us some fundamental secret which concerns humanity…. it is then clear that the child—the creature from which we have sprung—contains intact the directive principles of human life which we have lost" ("The Child's Place in Society" 17).

While working with elementary children of different ages from various countries in Kodaikanal, India, during World War II, Dr. Montessori and her son Mario began to see how truly appealing this concept of creatures working for the universal good was to them. They observed that elementary-aged children took a great interest in going out into nature, delving into the worlds of plants and animals, the ecology of terraria they had created, and the geological processes of earth-building and decomposition, including the awesome work of water. They saw that the child of six to twelve years could enter in his imagination the world of the very small (the atomic world) and the world of the very large (the galactic world), with the help of his reasoning mind and a mathematical propensity to enjoy "big" numbers. One could say, for example, that 710 million atoms of hydrogen could fit on the head of a pin to a child of this age, and the reaction was one of wonder and awe, and often a desire to research more about such a fact. This exploration of the Cosmos was found to be the perfect match for the intelligence of this aged child (Montessori, Maria, Unpublished lecture, January 29, 1940).

If we return to the story of the pencil for a moment we can see that not only does the teacher have to deepen her own knowledge of the origins and interconnections of things but she has to "expand her vision and be prepared to take immediate and spontaneous advantage of the situation" (Lakshmi Kripalani, conversation, October, 2005). The teacher has to deeply grasp this cosmic theory; has to embody, so to speak, the cosmic vision. She has to carry this deep sense of the "Transparency of Things" and grow her understanding of the unity or wholeness of Nature. She has to keep alive her own sense of wonder and excitement and be a parallel researcher with the children.

I would like to paint a picture of an example of the process of Cosmic Education as it deepens over time. The scenario takes place in an Upper Elementary



Upper Elementary botanical drawings courtesy of Gerard Leonard, The Montessori School, Wilton, Connecticut

classroom. A group of children became very passionate about plants and the study of botany—a passion that lasted all three years and I have no doubt will continue in some way into their future. This work not only fed some deep need of the age, but formed them as research workers. I reflected recently on the vast scope of what they did and its effect on the class, on the teachers, and on themselves, the intrepid and tireless workers. These students, principally a boy and two girls, including several others who also worked with them periodically, came to the class with the seeds of an interest in plants, real contact with nature from toddler age, and some essential botanical nomenclature. They entered a prepared environment where there were lots of plants both large and small and many varieties from cacti to palms to horsetails and cycads, and a broad span of monocots and dicots. There were examples from the Timeline of Life in the environment. Each child in the class also brought a small plant of their own choosing to the classroom, researched its needs, and had to care for it. The "Plant Lovers," or "Botany Club" as they came to be called, began to care for our indoor plants, at first one or two that they noticed needed some affection and attention, and then, soon enough, all the plants. They were given the time, the place, the respect, and the validation to be able to proceed and follow their interest.

Courtesy of The Cobb School, Montessori, Simsbury, Connecticut

Soon they were repotting plants, nursing plants back to health, asking questions, and researching what to do for certain blights and so on. The classroom, in addition to having all the Montessori botany materials, had a botany library specially designed to support research, with botany guides and other useful, hard-to-find books. Soon we had a plant hospital where plants needing care from around the school were brought and nursed back to health.

Parallel to this work, the children were receiving presentations on botanical illustration, hearing inspiring nature poetry, and experiencing great natural history writing read to them from famous authors, such as Annie Dillard, Edward Abbey, and Henry David Thoreau. In addition, they were engaged in their own nature writing, often outside, sitting on the grass or on a rock, or in the quiet of the woods. As they built their beloved forts in the woods, tended our gardens, and cared for the classroom plants, they began to notice more details and wanted to research even more. This is when they delved deeply into the botany nomenclature, illustrating and writing and then researching further and making their own extensions of the nomenclature, such as other seed types, extensions of monocots and dicots, and so on. They also began to research medicinal plants and began what was to become a huge compendium, alphabetized, with beautiful and carefully executed botanical illustrations and descriptions gleaned from various books and other sources. This study was to last all three years, and ultimately was to inspire a study of natural medicines from various cultures and a survey of the wildflowers in our woodlands. They discovered we had six endangered species of wildflowers growing in our woodlands. These flowers were tended by them daily and protected; trails were rerouted, and a map was made of the locations of the flowers so that they could be protected now and later once the students graduated. The excitement with which I was informed of the next blooming Lady Slipper and of the discovery of its interesting method of pollination was hum-

bling. They were captivated not only by the beauty of the plant world, but by its science and by the realization that they were needed and could be of service. All of this was an extraordinary experience for me. Something ignites in the adult heart in the face of such glorious love and passionate work. They visited the local garden club and arranged for an expert in conservation to visit the class and broaden our horizons even more. Throughout this time, the Botany Charts were re-examined, discussed, and our understanding deepened; certain botany experiments were done; the Chinese Box of Botany was mined for classification information on divisions and families, and fabulous websites were discovered such as the *Cornell Herbaceous Perennial Plant Database,* the *Harvard University Herbaria,* and the *Linnean Herbarium in Sweden*. It is important to say that this work was freely chosen and totally interest-driven. As Dr. Montessori so astutely observed: "Everything depends on being able to see and on taking an interest. It matters much more to have a prepared mind than to have a good teacher" (*The Absorbent Mind* 183).

Such study and attention to the small details of living things in an environment and with adult teachers infused with "a sense of Cosmos," with "the interconnections of things," will inevitably lead the child to the big picture. As Dr. Montessori so eloquently said,

> If we study, for example, the life of plants or insects in nature, we more or less get the idea of the life of all plants or insects in the world. There is no one person who knows all the plants; it is enough to see one pine to be able to imagine how all the other pines live. (*From Childhood to Adolescence* 35)

I have always been a great lover of trees, ever since I was a small child. I was fortunate to have been able to play freely in beautiful mixed woodlands with old oaks, ashes, and horse chestnuts, and occasional trees from afar that stirred one's imagination I recall a great monkey puzzle tree and unusually tall pines. When the swallows flew in from the south or the geese from the north, I wondered if they had seen these trees in their lands. And there were also the sacred trees of my people, among them the hazel with its nuts of wisdom eaten by the storied salmon of knowledge, in turn eaten by our great hero Cúchulainn; and the fairy tree, the hawthorn, that no one would cut down for fear of fairy retribution. I remember learning to identify all the trees in my locality. In an old estate where I liked to walk there were great lines of ilex or holm oak an unusual non-native tree. I remember how excited I was when I read in some old book that the monks in medieval times had imported these trees from the eastern Mediterranean because their leaves were good for making mattresses for the poor.

I still love trees; I find solace and inspiration in the two huge gingko trees in the park across the street from my home in Connecticut, the first trees to evolve and remain remarkably unmodified for the last 200 million years. I celebrate when I remember that they did not go extinct but were saved in ancient Chinese, Japanese, and Korean temple gardens. In the same park there is a great copper beech visited so often to play in its branches when my daughter was small, and only a mile away an eight-hundred-year-old sycamore, old already when the first settlers came here in the late 1600s.

"A great tree infuses empty space with memory and turns it into a place. . . ." (Balog 54).

Trees nourish my spirit when I spend time with them. These beautiful poetic words by Maria Montessori invite us out into the woodlands and further—for her vision extends from tree to Cosmos:

> There is no description, no image in any book that is capable of replacing the sight of real trees, and all the life to be found around them, in a real forest. Something emanates from those trees which speaks to the soul, something no book, no museum is capable of giving. The wood reveals that it is not only the trees that exist, but a whole, inter-related collection of lives. And this earth, this climate, this cosmic power, are necessary for the development of all these lives. The myriads of lives around the trees, the majesty, the variety are things one must hunt for, and which no one can bring into the school…. How often is the soul of man—especially that of the child—deprived because one does not put him in contact with nature. (*From Childhood to Adolescence* 35)

I share these very personal experiences and sentiments about trees out of a desire to stress the vital importance of the teacher in a classroom prepared for Cosmic Education being himself or herself deeply connected to nature in some rather profound way, such that not only the marvelous science makes you leap for joy, but the beauty, the poetry of the trees, the ocean, the peeper frogs, whatever calls to you

can literally make you weep. In *The Dream of the Earth,* Thomas Berry puts it this way:

> The fruitful interaction between the scientific and the religious-humanist vision is our greatest promise for the future as well as the great task of the educator, both in comprehending for oneself and in communicating this vision to future generations of students. (101)

The vision he speaks of is the new scientific vision of the Universe integrating the intellectual, the imaginative, and the spiritual.

I recall my first reading of Mario Montessori, Sr.'s article "Plants' Work." This opened up a whole new world for me at the time—the tree, the plant as an important contributor to the maintenance of the Earth. The trees and the grasses held precious soil together, mined for minerals and water with their roots, harbored and supported much other life; plants were photosynthesizers, capturers of solar energy and, with their moneran friends, nitrogen fixers. This scientific knowledge did not dampen my more poetic sense of trees and the world of plants, but rather began the process of opening my mind to look more deeply at these extraordinary beings.

Such is the ongoing "preparation of the teacher" in a Cosmic Educational setting. It is the essential other half of the preparation of the environment. For each of us, Cosmic Education has to be not only known but felt in some fashion in order that this understanding can permeate the psychic space and the work of the classroom. No doubt we must work at acquiring and updating our knowledge of multiple subjects (particularly natural sciences and history according to Dr. Montessori; see *Creative Development in the Child* 133) and become more cognizant of the keys in our timelines, charts, and tales—but this is not nearly enough.

To deepen this work we each have to find our way to making a heart and mind connection—for some of us it may be through poetry, art, or music—for others it is fortunately often through contact with indigenous traditional wisdom with its profound sense of interrelatedness with the Earth. For many of us today this connection happens through our growing acquaintance with the Great Epic of Evolution and the new discoveries of science—more awesome and wonderful all the time. This needed nourishment is also always available through spending time walking and sitting in natural settings, in the fields, the woods, the mountains, the desert. Thoreau advocated being a "saunterer" in the natural world. "In wildness is the preservation of the world," he said (paragraph 18).

"The child should love everything that he learns, for his mental and emotional growths are linked" so speaks Maria Montessori in *To Educate the Human Potential* (26). She goes on to quote Dante as saying: "The greatest wisdom is first to love." She lived this maxim herself. Dr. Maria Montessori understood that love and knowledge are intimately bound together. For example, her various writings on the cosmic task of "the cow" strike one in this way. She wants to communicate the important cosmic function of the cow in Earth's ecological economy and also her clear affection for this animal. Speaking in 1940 in India, a land where the cow is sacred, she describes the cow as an animal she "loves very much, as a friend." She goes on to describe how the cow has developed her four stomachs to digest the grass and "keeps on doing the work which was necessary for the formation of the earth, so that the earth can be ready to receive other forms of plant life" (Unpublished lecture, January 15, 1940).

We are reminded by Montessori that the cow's arrival was synchronized with the appearance of grasslands all over the earth (*What You Should Know About Your Child* 123). "The obedience of the cow to this great cosmic mandate [i.e. the maintenance of the grasslands and meadows in good condition] is wonderful," she declares (123). If one enlarges this picture to the great array of grazing and browsing animals all over the planet—the deer, the antelope, the bison, the moose, the zebras and so on, one encounters a world of not only great beauty but of great service.[4] "When an animal [such as the cow] acquires a function and becomes perfect," said Dr. Montessori, "a work of artistic beauty is carried out" (*Creative Development* 249).

And so our work as teachers is to create a "wonder-filled" learning laboratory and a large open door to the natural world so that children, according to their particular interests and via various details of study and observation, may begin to understand, and marvel at the "cosmic task" or "Telluric Economy"

[4] In his book *The Grass Eaters,* Gary Paulsen calls them "the biggest, the most graceful, the most complicated" of all animals (vii).

Courtesy of The Cobb School, Montessori, Simsbury, Connecticut

of everything from a tiny molecule of glucose to the work of bacteria, bats, oak trees, and the great biogeochemical cycles such as the carbon cycle. "Can children [of seven to eight years] understand the philosophy?" asks Maria Montessori. "Consciously perhaps not," she says, "but its impact at this age is a preparation for understanding later" ("The Meaning of Adaptation" 6).

In Mario M. Montessori's *The Human Tendencies and Montessori Education*, two factors are indicated in order that the child should "incarnate" his world: The first is to give the children keys as to understanding how the Earth functions and in addition how mankind is affected by how the Earth functions. Beyond this, another depth we have to explore with children through story and research is "the contribution that Man gives to his fellowmen" (2).

Dr. Montessori asks us to help the child to see that mankind is already united; she called humanity a "United Nation." In the words of Mario M. Montessori, "Mankind depends entirely on man. . . . All countries on earth are joined by every sort of relationship; they are so dependent on one another that they do form a whole" (*The Human Tendencies* 5).

We tell many stories of the great and famous inventions and discoverers of history from Archimedes to the present, and other great heroic men and women. However, Montessori would also have us celebrate in story the unsung heroes of history, the unknown person who domesticated the first dog, the inventor of the needle and thread, and also the modern workers of all kinds who labor namelessly so that we might live. For example, as many as three hundred of *il populo minuto* or "the little people" worked carrying lime and bricks for Brunelleschi's famous Dome in Florence. They were actually known as *uomini senza nome e famiglia*, "men without name or family." Their awesome work remains for us all to enjoy (King).

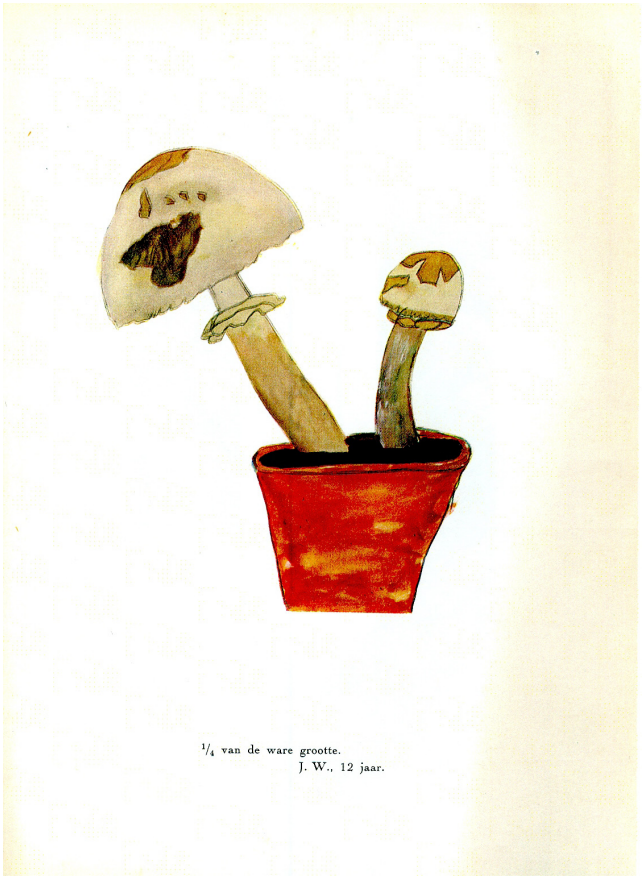
Gratitude is the feeling evoked when we understand how many people indirectly work to aid our survival. Maria Montessori challenges us to substantially change our outlook on these relations. Rather than simply seeing each worker as self-serving only,

we can help the child see how each contributes an essential part in the process.

Let us trace an ordinary Number 2 Eberhard Faber Mongol pencil's journey in the year 2005 (Wolken). We begin with cedar trees grown in California and the lumberjacks that cut them down. The logs are loaded onto trucks and delivered to a mill in San Leandro, California. Trucks run on diesel fuel. The diesel is derived from crude oil from OPEC countries like Saudi Arabia. At the mill the logs are cut into slats and the slats are shipped by rail to a factory in Wilkes-Barre, Pennsylvania. At the factory, grooves are cut in the slats and resources from around the world are combined to make the pencil. The "lead" is a mixture of graphite, clay, and gums. The graphite is mined in Sri Lanka and shipped to the United States in a Japanese-built ship. Candelilla wax from Mexico is added to make the lead smooth and strong. The graphite and wax are then mixed with clay from Mississippi. This mixture is put into the grooves in the slats and two slats are glued together. Nine pencils are carved from each sandwich. Each pencil receives several coats of lacquer—made from castor oil grown by farmers from tropical Africa.

The piece of metal that holds the eraser is called the *ferrule* and is made of brass (a combination of zinc and copper). Zinc is mostly found in North America (USA and Canada), Russia, Australia, and Ireland. Copper comes from South America and Africa (Bolivia, Chile, and Zambia). The eraser uses many ingredients including pumice from Italy and oil from a seed grown in Indonesia.

Think of how many thousands of people from many, many countries have interacted indirectly to make this humble pencil. Montessori calls this phenomenon a universal or cosmic charity at work. "It requires the lifelong dedication of each man to all mankind, the rich man and the poor man alike," she says (*Education and Peace* 139). This perspective can be awakened by looking at all kinds of production and economic exchange, by looking at the migrations of peoples and the particular gifts or contributions



Botanical drawings by 9- to 12-year-olds from The Amsterdamsche Montessori school courtesy of Leonard/Allen collection

brought to their newly settled areas of the world. Elementary children love this work, it is so right for them—it ignites their minds.

Beyond this, it is fascinating to ponder and explore the cosmic tasks of particular cultures and civilizations. Dr. Montessori points to the progress of Hellenic civilization and its great contributions via the Roman world to our present global civilization. We owe everything to our fellows past and present and their heroic strivings and sacrifices.

Dr. Montessori elaborated on this essentially religious sentiment of gratitude for the goodness and charity of human beings in an address to The World Fellowship of Faiths in London in 1939. She believed that despite our wars, our prejudices, and our blindness we were as a human race gradually working towards building a world of peace. She said, "If we educate children to see this [that is, "the disinterested goodness and self-sacrifice of his fellows"], they will ready themselves to feel gratitude toward all mankind. This is the affective aspect of our Cosmic Education" (*Education and Peace* 141).

We have a great challenge during these times of much international anxiety, strife, hatred, and environmental distress in our world, to hold in our hearts and minds the big picture, and for the love of our children and the future, to keep our own fire of hope and enthusiasm alight. We are among the first educators in history to be vouchsafed by our scientific community the Great Story of our Evolution and the first glimmerings of a time when we as a species may, in the words of Buckminster Fuller, write the manual for operating Spaceship Earth, and so inaugurate a "sustainable" future, a future in which the enormous developmental potential of the child will guide us toward a peaceful global society.

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