The Geology of New York City & the World: What Does It Tell Us about Ourselves?

By John Stern

I have loved geology, the science that deals with the history and structure of Earth and the life upon it, ever since I first began to study it in college. And I believe if people see how much this science has to do with our feeling, hoping, intimate selves, we will both know ourselves better and take better care of the planet that is our home.

I learned from Aesthetic Realism, the education founded by the great American philosopher, poet, and critic Eli Siegel, that how we see the world—whether we see it as for us or against us, and whether we hope to like it or despise it—determines how our lives fare. Geology can have us see that the world has a structure that is *for* us; that is, in fact, beautiful.

What does geology include? Are we ever separate from or unaffected by the geological world? I once felt the science of geology was very separate from social life and human emotions, which I saw as messy and unscientific. But through my study of Aesthetic Realism, I came to see that human life, human emotions, are governed by opposing forces like those within the inanimate material from which life arose. Mr. Siegel explained, for instance, in his 1970 lecture, *Once More, the World*:

> *We should remember that as we walk on a lane, let alone a pavement, we are just as geological as if we were in the Tertiary Period. The earth, anywhere you see it, is geology. What's under the sofa can be geology.... Geology is the study of the material of this rotund and revolving globe.... The Grand Canyon is geology, but a lane in Rockland County is also geology.*[1]

I've seen that the landscapes we love, the workings of the geological forces that create them, and our own deepest hopes are each explained by this definitive principle, stated by Mr. Siegel:

> *All beauty is a making one of opposites, and the making one of opposites is what we are going after in ourselves.*

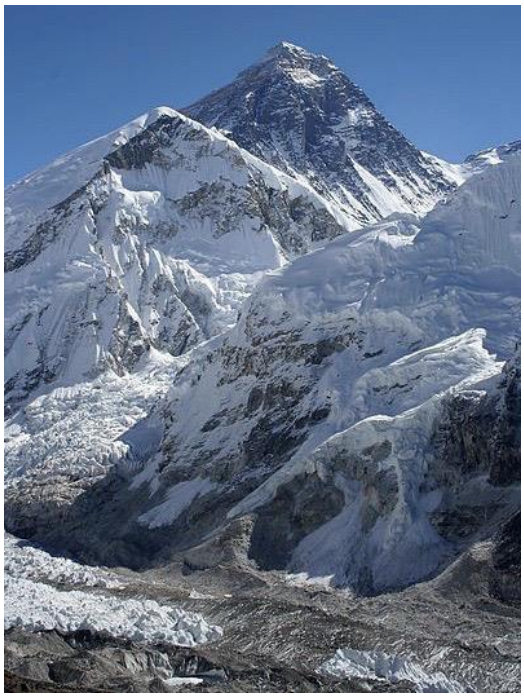
In this article I will show how geology is deeply explained by and puts together opposites such as surface and depth, warmth and coolness, hardness and softness—and how these are opposites that *we* are hoping to put together in ourselves.

The Drama of Rest & Motion, Surface & Depth in Earth & in Us

In the early 1900s, meteorologist Alfred Wegener, studying the shapes of the continents, theorized that these landmasses had once been a single supercontinent and then later had somehow drifted apart, but he couldn't explain what caused them to move. His hypothesis was at first widely derided. However, favorable evidence gradually accumulated over the years, finally leading in the 1960s to the emerging science of plate tectonics, which has profoundly revolutionized the way geologists understand our planet. It explains that extensive segments of earth's crust, called tectonic plates and up to 45 miles thick,[2] are constantly moving toward, past, or away from each other, at up to six inches a year.[3] To place this on a human scale, the average plate movement is roughly the rate at which our fingernails grow.[4]

What propels the plates? The principal force is convection currents churning ever so slowly within the white-hot, viscous magmas—melted rocks—that lie far beneath the surface. These magmas sometimes rise to the surface, often spectacularly, through volcanoes. It is in this zone, in the crucible of savage heat and immense pressures, that minerals prized for their beauty and/or utility—such as gold, silver, copper, diamonds, jade, rubies, emeralds—are created.

Where plates collide, or one plate's edge goes under an adjoining plate, mountain ranges such as the Alps, the Andes, and Himalayas have been raised. Where plates pull apart, oceans may form, sometimes with mountainous ridges rising far beneath the waters. For example, the massive, 1500-mile-long Himalayan mountain chain is still being slowly pushed up by the continuing northward collision of the Indian plate with the Asian plate. This action has, among other complexities, compressed horizontal sedimentary rocks originally formed *on the sea floor* upward into some portions of the world's highest peaks. Indeed, Mt. Everest itself has fossils of marine creatures near its summit, 29,000 feet in the air![5]



MT. EVEREST

The dynamism of our planet, and what goes on under its surface—including the physical contact of plate against plate—is akin to opposing forces within ourselves. In *Self and World: An Explanation of Aesthetic Realism,* Eli Siegel wrote:

> *The basic conflict in the human mind—present, I believe, in all particular conflicts—is that between a person warmly existing to his finger tips, and that person as related to indefinite outsideness….In every person there is a drive towards the caring for and pleasing of self; in every person there is a drive towards other things, a desire to meet and know these. Often this drive towards self as an exclusive thing collides painfully with the drive to widen the self.*[6]

I was once very exclusive, concentrated on myself and a few things I felt deserved my attention and care—and other people, unfortunately, were not among them. One of the things I am most grateful to Aesthetic Realism for is that it has enabled me to feel increasingly that opposites can be one—that I take care of myself by welcoming and being affected by the difference of the world, including in the form of another person, my dear wife, Faith Kestenbaum Stern. And I'll say more about this in a moment.

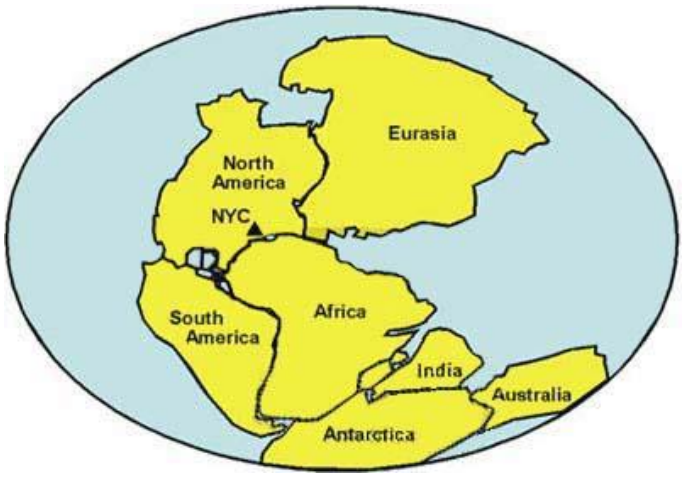
The operations of geology, then, are like what happens in ourselves—a study in the opposites of surface and depth, heat and coolness—only they take place on an impersonal and global scale. It is such forces busy at work tens of miles beneath the soles of our feet that create the continents and seas. As paleontologist Richard Fortey explains in his book *Earth*:

> *The face of the earth has its character scoured upon it by the elements, but they can only work on what has been set upon the surface by forces operating in the hidden depths.*[7]

For example, even as mountain ranges are being raised by the movements of the tectonic plates, these peaks are simultaneously being assailed and worn down by the untiring actions of rivers, rains, ice, and winds. These cycles have been repeated again and again and again over almost inconceivable spans of time.

During Earth's long history of more than four billion years, the plates have combined over tens of millions of years, forming a single supercontinent, and then separated again over many more millions, at least three times. The continents and supercontinents have found themselves at various times near the equator, in temperate zones, or near the poles. (To give some scale to the immensity of geologic time, consider that one million years—only a tiny segment of such time—is nevertheless equal to fourteen *thousand* consecutive human lifetimes of 70 years each!)

As such joinings and separations took place, some areas that are now land lay beneath the waters of oceans or inland seas, while some sea bottoms became dry land. The most recent of these supercontinents, Pangaea, was created about 275 million years ago, when dinosaurs began to roam the globe.



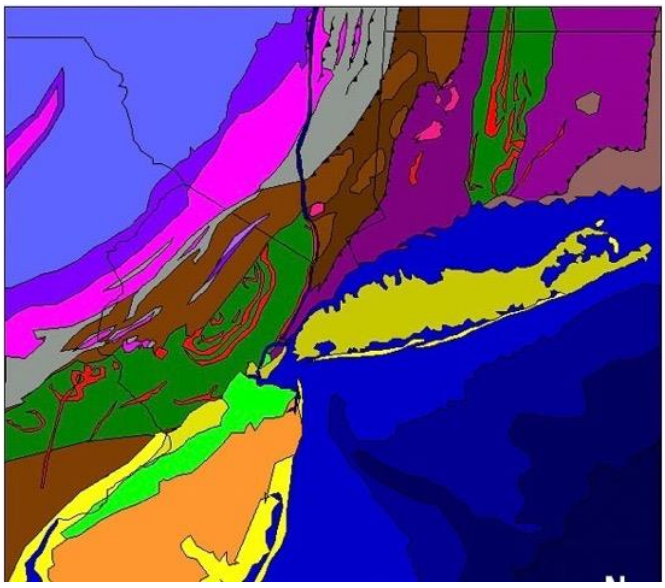
PANGAEA

Evidence for the existence of Pangaea is still being unearthed. For example, recent excavations for deep-level tunnels beneath New York City have uncovered the actual suture line where what is now New York City once was joined to Morocco in Africa (as shown on the map)![8]

An Astonishing Diversity: New York City and Vicinity

What a remarkable variety of landscapes the forces of geology have created in and near the great city! These are among the most complicated in America, because "the stony basement of the metropolitan area is one of the most complex in the U.S. in terms of the dazzling variety of rocks and their intricate construction."[9] Consider!

Within a mere 50-mile radius of Manhattan we find plains and beaches in New Jersey and on Long Island (yellow on the geologic map).



GEOLOGIC MAP OF THE NEW YORK CITY REGION

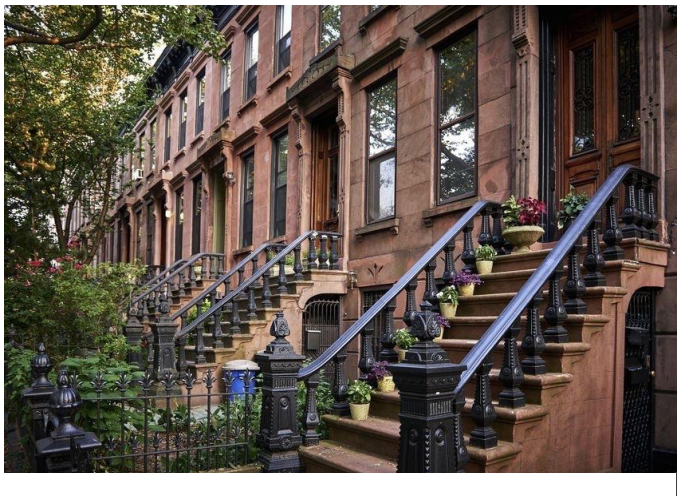
LOWER HUDSON RIVER

There are rivers, including salt water arms of the sea, such as the lower Hudson River.

Above it the sheer cliffs of The Palisades rise as high as 540 feet. These and other ridges, such as the Watchung Mountains, Hook Mountain, and High Tor—created by melted volcanic rock rising some 150 million years ago from far beneath the surface—are shown as narrow red lines west of the river on the geologic map.

PALISADES CLIFFS

Red-brown sandstones quarried in nearby New Jersey (dark green) and Connecticut provided the material used for the fronts of rows of mid- to late-19th-century brownstone dwellings in Manhattan and Brooklyn, so numerous and now avidly sought after.



BROWNSTONES

GREAT FALLS AT PATERSON

There is an impressive waterfall in Paterson, NJ. Most farmlands are in areas shown in the geologic map as gray, light green, and orange. Very old, complicated rocky landscapes (purple) can be seen in Manhattan, The Bronx, Westchester, and Putnam counties in New York, and in nearby Connecticut. The ancient, precipitous Highlands of the Hudson (including Bear Mountain, Storm King and Crow's Nest, [both pictured here] a billion years old and more, and shown in brown), are the remaining roots of much higher mountains of once. And in this region is the one place on earth that has produced more different minerals than any other![10] It's located near Franklin, NJ, only 45 miles from Times Square.

CROW'S NEST AND STORM KING

Knowing Our Own Hidden Depths

Surface and depth in geology bring up a universal human question: how much do we want to *know* what we feel? For example, I didn't like the fact that I had emotions I didn't understand churning inside me—somewhat like what may be going on inside a volcano that appears dormant. I wanted to appear calm, unperturbed—to be, as much as possible, like a quiet boulder in upstate New York! I also felt no one was good enough to show myself to. This feeling, I came to see, arose from *contempt*, which Aesthetic Realism describes as the most hurtful thing in us—it's the "disposition in every person to think we will be for ourselves by making less of the outside world."

At the same time, I was yearning to have the depths of myself *understood* and *explained*—and Eli Siegel did that gloriously! For this I thank him with all my heart.

In a class early in my study of Aesthetic Realism I mentioned a dream in which I was rolling out maps and rolling them back up again, which I often did in my work as an urban and regional planner with the Tri-State Regional Planning Commission. Mr. Siegel asked me:

> *Do you think you are like a rolled-up map? A human being unfolds himself like a map or he can roll himself up and be concealed like a lost scroll. Do you believe you would like to hide what you are?*
>
> *John Stern—Yes.*

Learning that my daily use of maps stood for a central question in my life—the question of how much I wanted to relate what I felt deep inside to what I showed other people—was liberating. I saw that I wasn't satisfied being concealed like a lost scroll, thinking I'd fooled everybody. I was learning to have a new and better purpose—to know other people and be known by them.

New York—and the Grand Canyon

Consider the complicated history of Manhattan. Eric Sanderson writes of the island almost as if it were a person in *Mannahatta: A Natural History of New York City*—and we can see the opposites of depth and surface are being described, and also warmth and coolness, past and present:

> *[It] has been part of the seabed, and lain for hundreds of millennia in the crust of the earth, deformed by extreme heat and pressure. Manhattan has had volcanoes, spent a dissolute youth in the tropics, known Africa and Europe on intimate terms, and crashed…into North America. Earthquakes, floods, drownings, and rebirths: Manhattan*

has known them all. Some of the rocks on the island today are over a billion years old.[11]

This drama of surface and depth is on display throughout Manhattan's Central Park, with its numerous outcrops of ancient rock, called Manhattan schist.

FOLDED SCHIST IN CENTRAL PARK

Much of this grayish rock, perhaps 450 million years old, has undulating folds visible on its exposed surfaces. These folds were formed many miles deep within the earth, as this rock was being profoundly changed by intense heat and pressure, and invaded by thin veins of other kinds of melted rock.

GLACIAL GROOVES IN CENTRAL PARK

These outcrops also show regular grooves on their uppermost surfaces, trending northwest to southeast, where 20,000 years ago vast sheets of ice hundreds of feet thick loosened and carried along soil and boulders from upstate New York and New England. As the ice slowly moved, those boulders gouged the regular grooves you can see in the park today.

Long Island as we know it was shaped by this ice. As it slowly melted, the soil and boulders it carried were deposited at its edges, such as this house-sized granite rock in Wildwood State Park on Long Island Sound, and the low ridges of glacial material (called moraines) that extend eastward more than a hundred miles from Greenwood Cemetery in Brooklyn to Montauk Point. The extensive plains southward of these ridges were formed by soil carried by water from the melting ice.

WILDWOOD STATE PARK BOULDER

Wonderful as New York City is geologically, it is hardly alone in showing the beauty of earth when surface and depth come together dramatically. Perhaps the most majestic example of these opposites visible at once is Arizona's Grand Canyon. From the Kaibab and Coconino plateaus on top, we can look down past colorful rock layer upon rock layer, to the Colorado River cutting through the oldest rocks a mile below, with all sorts of walls, ledges, promontories, and fancifully named shapes to be seen on the way down.

GRAND CANYON AND THE COLORADO RIVER

Can this magnificent interplay of surface and depth encourage us to look into our own depths more courageously? Many people are afraid to look at themselves too deeply, to know themselves. We don't think what we find will have anything to do with beauty. I certainly didn't, until I studied Aesthetic Realism and read this kind sentence by Eli Siegel: "*No self can truly know itself and be ashamed.*"[12]

Heat and Coolness Are in Geology and in Us

Heat and coolness are another pair of opposites that earth itself is trying to put together, as every human being is. For example, Mr. Siegel said in his 1965 lecture *Philosophy Consists of Instincts*:

> *Geology has these two things: it's either getting hotter or cooling down—which is just the way man's life is. We are asked, "Why don't you get excited?" and "Why don't you cool down, take it easy?"*[13]

People are more aware than ever before that hot and cold make our planet habitable. The relation of heat and coolness—as with other opposites—can be fearful and brutal, or sensible and beautiful. This has everything to do with the weathers and climates that hourly affect humanity: warm and cold ocean currents, snows and rains, droughts, deserts, polar ice, the nature of vegetation, the habitats of animals, the kinds of human shelter, the varieties of food crops. It is imperative that, as custodians of our planet Earth, we take responsibility for our role in the potentially catastrophic climate change that is happening now, which has people across the globe so deeply and honestly concerned.

Warmth and coolness are always present in how we see other people. Do we want to be warm to the best things in another person, hope to know and strengthen them? Do we want our heated moments to be in behalf of fighting for justice? Do we want to be cool, exact, in a way that's kind? These are emergent questions that affect everyone.

Like most people, I had no idea that I was trying to put together opposites. In fact, I thought of myself as a cool, scientific person, and viewed emotion with suspicion. I was a confirmed bachelor, and then, suddenly, I found myself having emotions I'd never had before as I was coming to know Faith Kestenbaum—now my wife for 49 years, who encouraged and assisted me importantly in writing this paper. We were both studying Aesthetic Realism in classes taught by Mr. Siegel, and I respected how she listened to criticism. I saw her kindness in wanting other people to be stronger—and

this included me. We began to meet for lunch. I couldn't wait to see her, but I often came late and also wanted to retreat into my shell. I was in a dilemma: should I be warm to Faith, or cool? Unconsciously, I felt it wasn't logical or scientific to be so stirred up.

Eli Siegel saw how mightily mixed up I was. In a class he kindly (and humorously) encouraged me to see which self it was that was stirred by Faith.

> *Eli Siegel—Look, many men have felt in reacting to a woman it's some shadowy self that is a little more disorganized than the customary one. It's a favorite way of damning womanhood. So if men react to a woman, then it's some spare self—not fully existing. Do you follow that?*
>
> *John Stern—No. I don't.*
>
> *ES—What does the other self which is not spare do? What does it react to? Does it react to geological principles, in which you've been so interested?*
>
> *JS—But my whole self reacts to these.*
>
> *ES—In other words your whole self reacts to scientific things, while your subsidiary, shadowy self reacts to Kestenbaum…. Would you say she is just as much a fact as geology is? Is she as much a fact as a certain rock formation near Hudson Bay?*
>
> *JS—Yes, she is.*
>
> *ES—Do you think that scientific minds should react equally to all facts, in terms of method?*
>
> *JS—Yes.*
>
> *ES—A woman is a fact?…A fact consists of two things: what it contains, and what it can do. A woman is like that. So Ms. Kestenbaum is a fact?*
>
> *JS—Yes, she certainly is.*

Mr. Siegel explained that science asks, what do things have in common? Where are they different? "Any time objects are compared in science, all the objects are supposedly seen better." He said that I would not be happy until I saw Faith Kestenbaum as standing factually, entirely for the world.

I began to compare her with Earth itself. Every person's body is a oneness of hills and valleys, high places and low, like countryside in Pennsylvania or Norway. Every landscape mingles hardness and softness in rocks, soils, vegetation, buildings, and so does every man and woman in his or her

bones, muscles, flesh, and attitudes. Earth is a composition of mountains, plains, and oceans on its surface, and of forces far below that make for these features. When I looked into Faith's eyes, I saw something so deep and mysterious, and my interest in Faith had me more interested in the feelings of other people, and in the world itself. Mr. Siegel composed this poem:

To J.S.: A True and Lasting Passion

He was in love
For the first time at forty,
The love of a scientist,
A true and lasting passion.

Hardness and Softness in Rocks and in Us

Hardness and softness are clearly central in geology. Some rocks are softer than others, and these are worn away more easily. As rains, rivers, and ice unceasingly sculpt mountain ranges, they create the valleys and chasms that may delight and awe us.

THE ROCKY MOUNTAINS

Can hardness and softness in rocks be related usefully to these same opposites in ourselves, and thereby be of great use to teachers and students

in the classroom? I believe what educator Barbara McClung tells about a class she taught in earth science to third-graders at a public school in Manhattan, using the Aesthetic Realism Teaching Method, is a model for how this subject should be taught in schools everywhere.[14] She describes how her students carefully studied the three kinds of rock—igneous (fire-made), sedimentary (water-laid), and metamorphic (any substantial alteration of the first two). They learned that instances of each rock type are made in different ways, and each shows a different relation of hardness and softness. For example, hard, dense granite and soft, air-filled pumice are both igneous in origin.

Barbara McClung explains:

> *These opposites are awry when a person is prejudiced: we harden ourselves to the feelings of people and are too soft on ourselves, assuming our own opinions are correct—without wanting to know the facts.*

As the semester continued, Ms. McClung describes what happened:

> *[As] the children saw how hardness and softness are joined beautifully in the rocks, a hurtful hardness changed in them: they no longer had the inert stoniness [they had had at the beginning of the semester]. They were excited, and with great care they examined many rocks, drew them, and described their color and texture. …[T]hey worked respectfully and eagerly together.*

Geology, Poetry, and Humanity

The study of poetry is important in Aesthetic Realism, because a poem arises from logic and emotion as one: something seen truly, felt deeply, and expressed sincerely. The opposites we are trying to put together in our lives are made one in every good line of poetry. "Poetry, like Art," Eli Siegel wrote "is the oneness of the permanent opposites in reality as seen by an individual."[15]

In speaking to poet William Carlos Williams in 1951 about the nature of the poetic line, Mr. Siegel described it in a way that thrilled me as a geologist:

> *[The poetic line] happens to be a combination of hardness and softness, swiftness and slowness, the visual and the musical, the spacious and the concentrated; and it is shown in what happens to the syllables, the vowels, the consonants, the kind of word used, the rubbing of one word against another, and the landscape of the line—*

the hills, the plains, the ditches, the chasms, the cliffs, the whole geography in the line.[16]

I did not see poetry as having much to do with geology, except metaphorically speaking, until 1972, when I heard Mr. Siegel lecture on *Earth and Poetry: There Is This*. "My purpose," he explained, "is to use geology to show what poetry is, and what aesthetics is." He showed, for example, that in a poem such as Samuel Taylor Coleridge's enduringly popular 1798 "Kubla Khan," the sounds themselves have the richness of Earth. It begins:

In Xanadu did Kubla Khan
A stately pleasure dome decree:
Where Alph, the sacred river, ran
Through caverns measureless to man
Down to a sunless sea.

The first line— "In Xanadu did Kubla Khan"—Mr. Siegel said, "has the depth of rock and the gorgeousness of Earth." And he asked, "How deep does reality go? Where does Earth's crust end and the interior begin?" We hear that awesome depth in the line "Through caverns measureless to man" and then the flat wideness of "Down to a sunless sea."

Later, three lines call to mind the geysers of Yellowstone and Iceland:

And from this chasm, with ceaseless turmoil seething,
As if this earth in fast thick pants were breathing,
A mighty fountain momently was forced:

And vividly geological too are:

And 'mid these dancing rocks at once and ever
It flung up momently the sacred river.

—lines that make the heavy light: presenting geology as cheerful, and giving it personality.

I was learning that the opposites that make up the study of geology are not just dry facts but make for deep feelings, and the feelings make the facts more meaningful. Mr. Siegel enabled me to see that opposites that are one in Earth—surface and depth, warmth and coolness, hardness and softness—are opposites that need to be one for geology, a poem, or a life to be beautiful.

It is an important advance in human knowledge that the study of the opposites, as Aesthetic Realism explains them, can have us understand

better not only the complexities of the earth that is our home, but also our individual, intimate, puzzling selves—and see both with greater depth, width, practicality, and pleasure.

As I conclude this paper about geology, I am personally moved. It is a subject whose width, depth, and power to surprise I love. I recently celebrated my 92nd birthday. That I could write about geology with so much feeling because I've learned what this science has to do with art and with our lives, I owe gratefully to Eli Siegel. He opened my eyes, heart, and mind to the amazing richness of the world, including the complexities in each and every person. In Aesthetic Realism, he has bequeathed to people everywhere the means of understanding ourselves and the wide world that stands up in whatever situation one may meet. It is true, and unfailingly kind.

I also want to thank Ellen Reiss, Aesthetic Realism Chairman of Education. In the 41 years I have studied with her, she has consistently encouraged my honest expression, and has helped my mind to become both warmer and more scientifically exact. She continues Eli Siegel's work teaching Aesthetic Realism, including "The Aesthetic Realism Explanation of Poetry" class. Through all I have seen over these years, it is my careful opinion that she is the foremost educator living today.

Acknowledgement

I want to thank my friends and colleagues Dr. Edward Green and Karen van Outryve for their kind, scholarly encouragement, which has substantially enriched this paper.

Photography by Faith Stern, John Stern, and the Internet.

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5/3/2019