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THE SAD THEORY OF ISOSTASY



by Miles Mathis

Isostasy is a theory that the crust and upper layers of mantle are in gravitational equilibrium, or “isostasis.” In my latest papers on [plate tectonics](#) and continental drift, I have thrown a few more passing spears at isostasy, though not by name. Specifically, I mentioned G. B. Airy again, and his ridiculous theory of reverse mountains. I hit that theory the first time in my long paper [on the unified field equations](#), where I also made passing commentary on Pratt and Vening-Meinesz, two other big names of early isostatic theory. Here I will extend my comments on isostasy, showing that it is one of the saddest longstanding errors of geology.

In researching my plate tectonics paper, I started by reading the fourth edition of Wegener's *The Origin of the Continents and Oceans* from 1929. There he mentions isostasy and the competing theories of Pratt and Airy. These two theories go back even further, to the middle of 19th century. Which means no progress on this question has been made in about 150 years. The current page at Wikipedia has almost nothing to add to these extremely old theories. Nor have we found a way to choose between them, although they contradict one another. They can't both be right. Nonetheless, modern geology keeps both in order to have a fallback if one or the other fails in a specific problem. In fact, we have now resurrected a third old theory, the flexural model of Vening-Meinesz, from 65 years ago. Although it contradicts Pratt and Airy, it is used to fill further holes. As with physics, geophysics likes to stack contradictory theories and then ignore the contradictions.

The biggest contradiction in isostasy is the Himalayas, which contradict all three theories. The Himalayas are not in isostatic equilibrium, as Wikipedia admits. But if so, what problem is isostasy trying to solve? If the lithosphere is not in fact in equilibrium, why do we need a theory of equilibrium? It is sort of like having three theories to explain the existence of seven-headed dragons.

This sad state of affairs goes all the way back to Airy, who was trying to explain in the 1850's why mountains don't deflect a plumb-bob. But the only problem was the expectation they would. Only physicists who misunderstood the gravity field would expect a deflection from mountains.

Kossmat, running the normal gravity equations of the time (which are still current), found that the Himalayas should deflect a plumb-bob 58 seconds. The actual experiment showed no appreciable deflection, or perhaps a deflection of less than 1 second. Several theories were then invented to explain this crushing negative data, which theories we will look at below. But Kossmat's solution was wrong because it was based on a misunderstanding of the gravity field. The expectation of 58 seconds of deflection at Kaliana (Ganges plain, 56 miles from base of mountains, blue dot in map above) was a false expectation. Let me run a simplified version of the equations for you, to show you the method. Then I will show you how it goes wrong.

We start by recognizing that the deflection is 90 degrees from the normal direction of gravity. The Earth is pulling down and the Himalayas are pulling at a tangent to that, or 90 degrees. Therefore, given the acceleration of the Earth of 9.8 and the prediction of 58 seconds of deflection, the solution is predicting an acceleration from the Himalayas of $.00175 \text{ m/s}^2$. The mountains are causing .0179% of the angle, therefore they must be providing that percent of the total force. Now, if we take the center of the Earth as the point from which its force emanates, we must take the center of mass of the Himalayas also. But once we start calculating a center of mass, we have to include the entire Tibetan Plateau, most of China, Mongolia, southern Russia, Kyrgyzstan, Tajikistan, etc. Just as a start, the Tibetan Plateau has an average elevation of almost 15,000 ft. So relative to Kaliana at 5,000 ft, the entire plateau must act like a huge mountain. In fact, everything in that direction that is above Kaliana should be included, especially any elevation which is above the Indian plateau which is pulling our plumb-bob in the other direction. Again, that would be anything above about 5,000 ft.

The reason this is important is because it pulls our center of mass far to the north, affecting our equation. The red dot in the map below is where I estimate the center of mass would be for this area. It puts us about 950 miles from Kaliana. Which—by the equation $a = GM/r^2$ —gives us a mass of about $6.16 \times 10^{19} \text{ kg}$ for the deflecting mountains.



Can that be right? That's about 97,000 times less mass than the Earth as a whole. What's the approximate volume of that patch? Well, from the distance scale printed on the map, it looks like about 9 million square kilometers or 3.5 million square miles, with, say, an average elevation 5,000 ft above Kaliana. $4.88 \times 10^{17} \text{ cu. ft.}$ or $13.7 \text{ million km}^3$. That is 1/79,000 the volume of the Earth, which is off

our previous calculation by only 1.23x. I have pretty much matched the old solution, with just a few rough estimates.

My assumptions were roughly the historical assumptions. What is wrong with them? What is wrong is that this rather large area is being taken as the cause of two separate forces. When we calculate the acceleration of the Earth 9.8, this patch is part of that force. It is part of the mass of the Earth, therefore it is part of that sum and part of that center of mass. So in a way, our math is implying that this patch is pulling the plumb-bob *both* down and to the side. Does that make any sense? No.

You will say, “So just subtract it out of the Earth's force. It is only 1/100,000th of the volume, so it won't change 9.8 by much. It won't affect the number 58 at all.” But that isn't the question. The question is whether the kinematics and dynamics makes any sense. I think anyone can see that it doesn't. You can't just “subtract it out” to suit yourself. The force from that patch either has to cause a force down or a force sideways. **It can't cause both.** And in other problems, it causes a force down. How can we make it cause a force sideways here? If we go stand on the top of Everest, the force is down. It can't be sideways at the same time. Geologists and physicists have just assumed that gravity can work like this, but we have no evidence it does. In fact, the negative data from plumb-bobs and mountains is very strong evidence that gravity does *not* work like this. I can't think of evidence that would be more clear or convincing to me.

The reason gravity does not work like this is that gravity is a field. That was true for both Newton and Einstein. At any point in space, there is a gravitational field. That field creates both an acceleration and a force. But that force and acceleration are both vectors, and vectors can only point one way at a time. The gravity field of a mountain cannot point down and to the side at the same time.

You will say, “Sure, why not? It is just a vector addition. If the two vectors are orthogonal, the total vector will be somewhere in between, as you just showed in your math above.”

Yes, that is obviously what has been assumed all along, but the plumb-bob disproved it. It doesn't work that way. Why? Because when we do a vector addition, the two vectors have to be independent. We don't have that here. The Himalaya vector is already part of the Earth vector, so it can't be separated out like that. The Himalayas are part of the Earth. They are not a separate entity, like a giant mountain range from another planet that just landed here or a small moon that just touched down. The mountain range has no separate existence from the Earth, and this is crucial. The lithosphere may have some degree of motion relative to the athenosphere, but for the most part its major motions are determined by the motions of the Earth. A mountain range isn't even as independent as you or me, and we also get our major motions from the Earth (major motions like orbiting the Sun, for instance).

If you still don't see what I mean, it may help to reverse all the vectors, as I did in my early expansion papers. [I have now offered other explanations for the cause of gravity](#), but we will always be allowed this vector reversal by the equivalence principle (see Einstein), and it has been very useful in the past for visualizing the way gravity works. Simply take every gravity vector in the universe and reverse it, simultaneously. According to Einstein, nothing would change in the math, and we would notice no change. Instead of a pulling force, the vector now implies that everything is expanding very fast, but at the same relative rate. Since the Earth gets twice as big and I get twice as big also, I don't see the Earth getting bigger. It stays the same size relative to me. But this expansion explains the apparent force of gravity.

At any rate, if we make this switch, we can see why the old explanation for the Himalayas fails. The

Earth is expanding, so every point on the surface of the Earth is moving straight up, away from the center of the Earth. So the Himalayas are moving up, and if you are holding the plumb-bob at Kailiana, so are you and the plumb-bob.

So far so good. But you will tell me the Himalayas are also expanding to all sides, which is true. Therefore, there should be a sideways vector between them and the plumb-bob. Not so fast! The ground between the plumb-bob and the Himalayas is also expanding, at the same rate as everything else. And this expansion of the ground in between actually *negates* the sideways vector. The plumb-bob and the Himalayas are NOT getting closer to one another, therefore there is no sideways vector. Once we reverse the gravity vectors like this, all the vectors are representing real motions, not forces. So if we have no real motion of the plumb-bob and Himalayas toward each other, we have no vector.

In this way we see that there is no vector addition. And we see that the *reason* there is no vector addition is that the Himalayas act as if they are part of the Earth. They are firmly attached to some position in the gravity field of the Earth, and are not free to move independently. The same can be said of you and the plumb-bob, standing there at Kailiana. Since you are fastened to that spot (by friction or inertia or the centrifugal force—however you wish to explain it to yourself, it doesn't really matter here), you are also acting as part of the Earth. Your gravity field is determined by the Earth, and there are no vector additions involved.

Now, if we could unfasten you from the Earth somehow, by negating those forces that are holding you there, then yes, we could do the vector addition and find lateral forces. But that isn't the case.

If we reverse all the vectors back to the way they were, we return to old physics where gravity is a pull. But we return to that old physics with a better understanding of the kinematics of the gravity field. You should now understand that the Himalayas must act either as part of the Earth's field, or as their own field. They cannot do both simultaneously. If we try to do a vector addition like Kossmat and Airy, we must be assuming that the Himalayas can act as if they are simultaneously producing two fields. I have shown that they can't. The 1 degree of deflection found was either a margin of error or it was caused by something else.

Those who haven't read all my papers will dredge up Cavendish here, and send me to play with a modern Cavendish device, which would be intended to show me I am wrong. But these readers are recommended to [my paper on the Cavendish device and historical experiment](#), where I show that it has been misread in precisely the same way the plumb-bob has been misread. I unwind the equations and the experiment, showing that gravity is *not* causing lateral forces between small objects like apples or stones. What is causing the motions in the Cavendish device is charge.

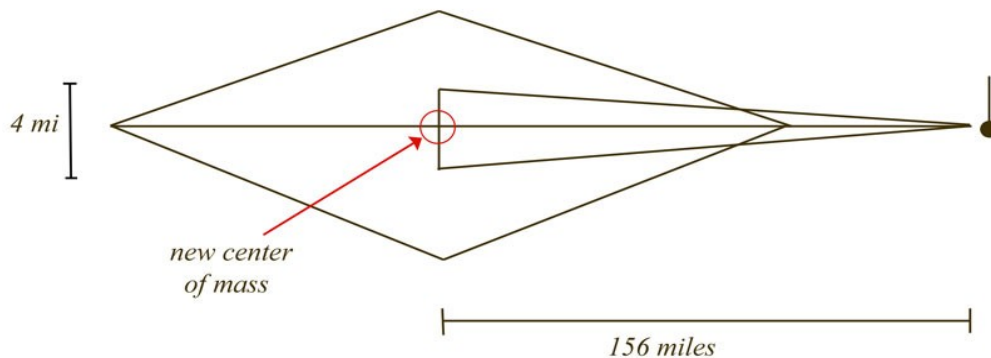
But I haven't needed to bring charge into the picture in order to show how the old math and theory fails with the gravity of mountains. Even using current equations I can show what I want to show, without going into new unified field theory. What I want to show is that old geologists couldn't do applied math, that new geologists can't either, and that physicists have been no help in spotting this mistake. Like thousands of other fairly simple problems, it has been sitting right out in the open for a century and a half.

How could that happen, you may ask? It happened because all the top mathematicians quit looking at mechanical problems around 1830. They got diverted by Gauss and Lobachevsky and Bolyai, then by Riemann and Klein and so on. None of the top guys and gals have sullied their eyeballs by looking at simple algebra or straightforward kinematics since before Maxwell. They were no help to Airy and

they are no help to geophysicists now. At the present time, they are too diverted by the eleven dimensions of string theory, virtual particles, gauge math, symmetry breaking, borrowing from the vacuum, and so on, to be of any help to geologists or geophysicists. Remember, Airy was partially responsible for the Tay Bridge disaster, miscalculating the forces there by a large margin. And contemporary geophysicists still don't go into the field because they are math whizzes. Math whizzes go into math or particle physics or something. Geophysicists have never specialized in gravity, and they especially don't now. Even physicists don't specialize in gravity, and haven't for hundreds of years. About the closest thing we now have to a gravity specialist is a Relativist, but since Relativity is said to have been finished with Einstein, almost no one goes into it. It is a closed field with almost no living practitioners. And these few living practitioners of General Relativity are also poor at Newtonian math, since they were taught it had been superseded. So they are useless when it comes to these straightforward geophysical problems.

But the problem of isostasy crashes way beyond the math. To “solve” this problem created by bad equations, Airy then proposed reverse mountains underneath the visible ones. This was supposed to create a “mass deficit” that would counteract the pull from the visible mountains. A simple diagram will show that this is also absurd.

To avoid the complexity above concerning the Tibetan Plateau and so on, we will return to the original simplification, where only the nearest mountain is affecting the plumb-bob. The vertical center of mass of our mountain would be about 1/3 of the way up, let us assume, due to more mass low in the mountain (the tops of the Himalayas are limestone, clays, and silt, rather than granite and marble and so on). If so, then the reverse mountains would also have a center of mass 1/3 of the way *down*. Let us be generous and call that 10,000 ft, up and down. Roughly two miles, in other words. If we use the old given distance of 56 miles at Kaliana, we still have to include the distance to center of the mountains, which—let us say—is 100 miles, giving us a total of 156 miles from center of mountain to plumb-bob.



Taking the inverse tangent, we get an angle of 1.5° at the plumb-bob, doubled to 3° top and bottom. Perhaps the diagram can make you see that the reverse mountain doesn't help us at all, since it doesn't keep the plumb-bob from being deflected. In fact, it would double the deflection by doubling the total

mass of the mountain. By the given and current rules of gravity, we would just re-calculate a center of mass, which would be right on line with the plumb-bob, negating the angles we just found. If Kossmat originally calculated 58 seconds of deflection, he should calculate 116 with Airy's reverse mountains. Airy's proposal actually makes the problem worse.

As I said in my previous paper, the only reverse mountain that would help us is a reverse mountain *behind* the plumb-bob:



That reverse mountain would solve the problem, since the plumb-bob is now at the center of mass of the two mountains. The deflection forward would be offset by the deflection backward. I would once have assumed *that* proposal is too absurd for physicists or geologists to make, but I am now no longer sure. I have some fear that the above diagram will soon end up in *Scientific American* or the *Journal of Geophysical Research*.

Almost equally absurd was Pratt's theory that mountains and sub-mountains are less dense than other areas of the lithosphere, due to pulling or decompression. After studying my diagrams, you can see that this theory also utterly fails to address the plumb-bob problem, which it was designed to answer. The only density that would serve here is a density of zero: otherwise we should still see deflection of the plumb-bob by the current equations and assumptions. Or, rather, with a *measured* deflection of 1 second, Pratt needs to show that the Himalayas weigh 58 times less than thought, which means they need a density 58 times less than thought, which means they need a density of about 3 lb/ft³. That's about 1/5th the density of bark mulch or cork. It is 1/10th the density of powdered milk.

Even Wegener gets confused when he starts talking about isostasy. On p. 40 he says,

It has been shown that the gravitational force measured at the surface of the oceans has about its normal strength in spite of the obviously large mass deficit represented by the ocean basins.

But wait, how is the ocean basin a mass deficit? If we are measuring gravity in a boat on the ocean, the ocean basin is below us, just as the mass of the Earth normally is. How is that a deficit? The only mass deficit is in the water, which has a density deficit compared to earth and rock. Salt water is about 2.7 times less dense than a combination of rock and earth. But since the oceans are only 4,000m deep compared to a radius of the Earth of 6,380,000m, the difference is negligible. That's 1 part in 1,600. And we now know that the ocean basins are about 1.07x denser than the continental basins. Since the oceanic crust is 100,000m thick, that density more than offsets the density loss from the oceans. So you see, the ocean basins aren't mass deficits, they are mass surpluses. If they *add* to the gravity estimate, they can't be gravity or mass *deficits*.

As an example of the contradictions created by all this, we may look at a prime example from Wikipedia, under the subheading “Isostatic effects of plate tectonics”:

When continents collide, the continental crust may thicken at their edges in the collision. If this happens, much of the thickened crust may move downwards rather than up as with the iceberg analogy. The idea of continental collisions building mountains "up" is therefore rather a simplification. Instead, the crust thickens and the upper part of the thickened crust may become a mountain range.

You may ask yourself, “If continental collisions create mountain ranges, shouldn't this collision add to the density in the area? The sentence above tells us that 'the crust may thicken.' Isn't a thickening a density increase?” If not, why not? Normally pressure and collisions cause compression, which cause greater densities. Why would pressure on the lithosphere create “thickening” as in a spreading out, but not thickening as in a greater density? It is both counterintuitive and counter to all previous evidence to propose that the leading edges of colliding plates or continents are not compressed. If mountains are created on the leading edges of collisions, they should be compressed, and therefore should be the most dense, not the least dense.

To say it another way: if we apply pressure from both sides to a compressible material, it should compress. If it compresses, it has gained density. If anything it is capable of applying large amounts of pressure, it should be continents colliding. The leading edge of this collision must be compressed, and it must be compressed the most. **Quod Erat Demonstrandum**: higher density.

Likewise, if the Himalayas have been and are being created by the northern movement of the Indian plate, shouldn't that movement increase density? And yet the two leading theories of isostasy—Airy and Pratt—tell us that mountains are *less* dense than surrounding areas. That is what is called a theory-ending contradiction.

To read more on this subject, you may go to my next paper, on [the Schiehallion experiment](#), where I analyze an earlier Scottish experiment on deflection of a plumb line.