

and the mildest Soap, as it has been found by Experience in all our Manufacturies.

The Observations which I have lately laid before the Academy, prove that the Oil, which has passed through the Lyes of Lime and of Salts, is, perhaps, easier to digest than any other. I there demonstrate, that the Oil separated from the Soap by the means of Acids, as I have pointed out, is found to have acquired a Property which it had not before; for it dissolves in Spirit of Wine, and perfectly unites with it; which it could not do whilst it was crude, that is to say, before it had formed Soap, or had been boiled with metallic Limes.

VI. *A Letter written to the most Reverend Father D. Cla. Fremond Calmad, publick Professor in the University of Pisa, giving an Account of the Earthquakes felt in Leghorn, from the 16th to the 27th of January 1742. With some Observations made by the most Reverend Sig. Pasqual R. Pedini, Principal of the Clergy of the most eminent College of the said City. Communicated to the ROYAL SOCIETY by James Jurin, M.D. F. R. S. &c.*

Read April 8.
1742.

IN Obedience to your Commands, I transmit you an Account of the Earthquakes felt in *Leghorn*, from the 16th to the 27th of *January*.

January. I suppose you have observed at *Pisa*, the unsettled Weather, as we have here; continual Rains, sometimes more, and sometimes less; continual Winds, chiefly from the South and West, so that scarce any in this City remember to have seen the like. We cannot be said to want Wind here, since scarcely a Day passes without it, from some Point or other. But to observe in the Country one Wind in the Morning, another at Noon, and then a third at Night, is what surprises us. In some Days, especially after the Winter Solstice, there have been felt extraordinary warm Southern Breezes, from whence People drew an ill Omen of the Health, or other Misfortunes, which every one figured according to his own particular Fancy: However, no one thought of the present Calamities, the Reasons of which are unseen by mortal Eyes; for where shall we find those Telescopes through which our Sight may reach the subterraneous Receptacles of that Matter, which, whether burned or fomented, makes the whole Earth start, and terrify Man? I look upon the Foresight of these Accidents, as an Undertaking impossible to accomplish, and the prophetic Fixing them to a certain Time, much more so: But observe to what a pitch Ignorance or Fear carries some People; after the first Shock of the Earthquake, every body was in great Consternation within this City, not so much for what they immediately felt, as through Fear of another infinitely more violent, which a certain *Milanese* Astrologer predicted to happen (as they said) the 28th of *January*. By Misfortune he was within a Day of it, the great Earthquake being the 27th; by this means the Faith and Credit given to the Astrologer increased so

so much, that I do not know whether he has not more Reverence and Honour shewn him than the Prophets, and holy Gospel. There is no need to prove, that this Science does not belong to Astrologers; for Effect shews it, since the Earthquake came a Day before his Prognostication. He has moreover predicted another Earthquake to happen the 6th of *March* next, upon which Numbers who are in the Country, and some at *Pisa*, will not return to *Leghorn* till that Day is past.

The 16th of *January* was a very temperate Day, with a gentle Breeze between South and West: A little after Twenty-four Hours (about Six at Night, according to our *English* way of reckoning) I observed a certain dark Cloud, which passed with a bad Smell; of this I took but little Notice, having often smelt the like; and what might occasion a a greater Inobservance, was, a great Cold, which prevented my distinguishing between Smells, whether good or bad: However, I saw this Cloud, blacker and thicker than the rest, settle within a Foot and an half on the Tops of the Houses, like the Smoke that the Peasants make in an Evening, when they burn their Garden Rubbish, or such-like. On account of the Cold I had, and this black Cloud, I went into a Friend's House: Finding him with Company, after a little common Discourse, he returned, it being *Tuesday*, and I remained with a few more, At Two Hours in the Night, (Eight o'Clock *English*) we thought the Pavement gave way, and the Chamber shook: Some of us thought it proceeded from walking in another Chamber, others thought it was a Shock of an Earthquake; upon which I listened
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attentively, to hear if there might be any consequent Motion or Noise in the House, that I could attribute it too ; but on the contrary every thing was quite still : Upon this I went to the Window, and found a small Air from the South ; the dark Cloud was no longer to be seen, but a thin slight Obscurity in the Air. Scarce a Quarter of an Hour passed, but the Chamber received a more violent Motion than the former, though not to frighten us very much. I observed a Motion in the Candles on the Table from West to East. We then heard all the Bells in the City ; on this my Friends and I went out of the House, and staid abroad till Four Hours. I smelt the Stink no longer, but observed the Clouds increasing and thickening on every Hand, but always with a white Hue, like the Circle which is often seen round the Moon, but of a prodigious Extent. Every body's Eyes were busied at this, looking on it as the Forerunner of something extraordinary, though nobody knew what would be the Event. Many asked my Opinion of this Novelty : I told them, I had observed the same thing very often, and that the Consequence was sometimes Rain, or Wind, and very often nothing at all : In short, I persuaded them it was nothing out of the common way, and did not portend any future Evil, as they thought. But returning home a few Minutes after Four in the Night, I was got about half way up the Steps, when another violent Shock began, far superior to the two former, which lasted about the time one might say an *Ave, Maria* ; the Motion was sudden, and the shaking of the House was from East to West : The House wherein I live being South, and I standing fronting it, staggered twice to the Right Hand,

Hand, and in great Danger of falling down all the Stairs.

At Ten Hours and a half, were heard by many two other Shocks, (with a small Intermission of Time) much like the two first: however, I was not sensible of these. One waked me at Eleven and Three quarters, and another about an Hour after: These were perceived by every body, but were of no Consequence; and I being between Sleep and Wake, could not tell which way the House moved. In the Morning the 17th of *January*, after the last Shock, there fell a little small Rain, like Hail, which turned to Snow about 14 or 15 Hours, which fell in such Abundance for an Hour, that the Streets and Tops of the Houses were quite covered; and a little more after Mid-day, which continued all the Remainder of the Day. On the 18th there were no sensible Shocks of the Earthquake, but there were now-and-then visible Undulations of the Ground, though of no Consequence. The 19th in the Morning, at Sunrise, there were between the East and South certain Clouds very thick, which dispersed as they came nearer to the Solar Disk; but there always remained a particular uncommon whitish Thickness in the Air, till Sixteen Hours, when it was intirely dissipated; a small Gale rose from the South, which soon fell again, and changed to the West; the Sun was so scorching, that it racked the Head to stay in it. At Eighteen Hours and a half, I heard a rumbling Noise, which seized me with Horror, and expected an Earthquake was at hand, neither was I deceived, the House began to shake, and continued the Motion Eight to Ten Seconds: It came like a Blow, and the House

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waved from West to East. At Nineteen Hours exactly, followed another Shock, which lasted about Three Seconds; but I did not observe any Motion of the Building, being so surrounded by Numbers of People, that I could not stir, nor raise myself from kneeling, being then at Church. All the Remainder of the Day, quite till Twenty-three Hours, the Earth was in continual Motion; and exactly at Twenty-three Hours followed another Shock, like that at Eighteen Hours and a half. I felt nothing at all of this, by the Increase of the People, who poured in upon us. However, at Two Hours, Three and a half, and Three Hours Fifty Minutes, I perceived Three small Shocks; and from that Time to the 20th of *January* at Twenty-three Hours and a half, I felt nothing: At this Hour there was a small shuddering, which was not universally observed. At Five Hours Twenty-five Minutes in the Night, followed a Shock like that of Eighteen Hours and a half of the 19th Day, with this Difference only, that the House waved from South-east, and continued between Ten and Twelve Seconds; there followed a strong Undulation of the Ground (something interrupted) until Twenty Hours of the 21st of *January*; at Twenty-three Hours of the said Day, being in the great Piazza of the City, I found a small Motion of the Ground, which was observed by a few more, that I happened to be in Company with.

Some Fishermen told me, that at the same Hour on the 19th Day of *January*, that we had the terrible Shock at *Leghorn*, they being at Sea between *Meloria* and *Gergona*, saw a small Part of the Sea rage violently, and raise itself to a great Height in a white Foam,

Foam, with a dreadful Roaring, and frightened them so far as to imagine themselves lost, though it did not directly beat upon them, but felt it on one Side only; which made them imagine some violent Mischance at Shore; and keeping their Eyes always on that troubled Part of the Sea, perceived it made towards *Leghorn*, and broke on the old Fortrefs, which for a little while was hid from them. The Captain of a Ship, who came to this Port, says, that he saw, to his great Surprize, a few Miles distant from *Capo Corso*, several Streams running with great Impetuosity different ways, and so very rough, that although he had a very fair Wind, he expected every Moment to be lost. This must have happened just before the Earthquake of the 19th of *January* above-mentioned.

From the 20th to Twenty-three Hours of the 25th of *January*, the Ground was in a continual Agitation: I suspected it might be my foolish Apprehensions: I asked every one I saw, but every body agreed there was some little Matter. To assure myself of the Truth, I put Water in a Bason, and put it on a Plain, observing it every time I thought I felt any thing, and saw it move: I continued this Observation till the 26th of *January*, and at Twenty-three Hours on the 25th Day, there was a much greater Motion than that of the 20th Day; and from that Hour until Eighteen Hours Three-quarters on the 27th Day, there was not the least Motion perceptible: Upon this I hoped the Evil was past, and comforted myself with thinking that Matter spent to which the Philosophers attribute this horrid *Phænomenon*; but found myself mistaken, for when I least expected it,

and my Mind quite otherwise engaged, I was surpris'd the said Hour with a most dreadful Noise, which was followed by a treble Shock of the Earthquake in the most frightful Manner, and beyond measure violent; it began by a succussive Motion, and followed by a sort of Blow with the horrible Violence; and at last came another succussive Motion, more horrible than the former: There was heard from under-ground a hollow terrible Rumbling, as if the whole Earth had broken to Pieces: It had a Motion like turning, and continued moving; the Houses waved Thirty or Thirty-two Seconds, from East to West. I looked upon myself quite lost, and expected nothing less than the immediate Ruin of the House, especially when I beheld part of the Door-case falling, and the Partition-walls cracked; the Mortar fell all about like Rain, the Furniture and Cloaths hung to the Walls fell all down; in this I was confined, without being able to seek Safety out of the House, but stood fixed, and nailed up, (as it were) by the surrounding Crowd of frightened Wretches that flocked in upon me: At last, however, I got out, and could hardly believe my Eyes, when I found the Houses all standing, having figured things much worse than I found them; yet every thing has suffered very much, there not being a single Edifice but what is damaged; although a great part of the Hurt within the Houses proceeds chiefly from the Roguery of the Builders, who either when first built, or in repairing, used bad Materials; those which are well built have suffered scarce any thing: Some must inevitably be rebuilt, chiefly those which remain leaning to one Side; which proceeds chiefly from the Load occasioned by
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their being raised so high. What has most surprised me is, the Number of Cracks in the Walls of this Collegiate Church, which were built without sparing any Cost, to make them a complete Piece of Workmanship, and are of an extraordinary Thickness, as one may observe in some of the Openings in the Building and Vaulting, which was esteemed superior to any in this Town: From hence you may conceive a just Idea of the extreme Violence of the roaring Earthquake. As for myself, I look upon it as a particular Providence, that the whole City did not go to Wreck; and had not the Houses been in general very good, they must have come to the Ground. The Ruins consist in, *viz.* the Roof of the Church of *St. John Baptist*, the Convent of *Augustine* Friars, the Roof of a Palace called *Rosciano*, belonging to the Family of *Borghesi* of *Sienna*. Besides these there are few others of Consequence, and but Three People killed. There is an immense Quantity of Iron Chains used, to keep the Walls of the Houses together.

Upon account of the Inconveniences attending this Earthquake, an infinite Number of People went out of the Town; the Houses and Shops were abandoned instantly, to seek Refuge in the great Piazza: So great was the Consternation, that no one knew what he was about. It was an Object of the greatest Compassion, to see the Astonishment and general Confusion that prevailed; every body looked pale as Death, without knowing what he did or said. There was another small Shock at Nineteen a Second, at Nineteen One-quarter, and a Third at Twenty Hours: After this last, I staid till Twenty-one Hours of the 30th of *January*, and then went away to breathe a little

little of pure and more quiet Air that you enjoy, and observed no further considerable Motion of the Earth; there remained, however, a continual Undulation, sometimes more, sometimes less; but must own, that from Twenty-two Hours of the 27th of *January* to Thirteen Hours One-half of the next Day, I could not perceive any thing, because I retired, and went to lie on board a Ship.

We may observe here, that some Earthquakes happen in cloudy, some in serene, some in still, and others in quite stormy Weather. The 16th of *January* at Night, was Snow and Clouds, as above-noted, with a very small South Wind from Midnight to Break of Day; the Fogginess turned into Clouds, which afterwards became Sleet and Snow. On the 19th in the Morning, was a bright Sun, but a gentle Breeze; about Twenty-three Hours it was cloudy, which at last covered all the Sky, continuing cloudy all that Day and the next Night, when at Five Hours Twenty-five Minutes followed the above-mentioned Earthquake; and in the Morning about Thirteen Hours, there fell a small Sleet and a Westerly Wind. Before the Earthquake on the 19th, the Waters swelled, and then fell again; soon after they swelled half a Yard higher than they ever were used to do. I was told by many, that the same Night and the following, there was a strong Smell of Sulphur in the Streets; but my Cold prevented its being perceived by me. This Smell was likewise found in the Water of some Wells. The Sea was seen in sundry Situations, now high, and then presently very low again; sometimes strongly agitated, and at others on a sudden calm. On *Sunday* the 20th of *January*, a small
Sleet

Sleet fell all Day, and the Air was changeable till the 27th in the Morning, being by turns, serene, cloudy, foggy, windy, and damp, with South and Westerly Winds. The 27th in the Morning, was a pleasant fine Sky, and a bright Sun, but excessive hot: About Sixteen or Seveenten Hours, a brisk Westerly Wind arose, and with this full Wind we sustained, at Eighteen Hours and a half, the violent Shock of the Earthquake; the Waters were observed to rise as high or something higher than the 19th. At Night, between Twenty-four Hours and One Hour in the Night, it became cloudy in the West, with a strong Wind; from Midnight to Day-break, fell a small Sleet, which continued (with some Interruption now-and-then) till the 28th Day; between whiles the Sun shone. The 28th at Night, and the 29th Day, it rained violently, accompanied by strong blustering Winds from the West. The 29th it was all Day cloudy, with the same violent Wind and Rain. The 30th the Sun began to appear, but the Clouds were not all dispersed. At Twenty-one Hours this Day I left *Le-ghorn*, and have not been able to make any further Observations.

It is said here, that the Sea roared with such Violence and Smartness, that its Noise was like the firing of large Cannon. I have not seen any body who was then at Sea, but a Friend of mine informed me, that a Fisherman (a *Frenchman* by Nation) being then in his Boat, found it of a sudden raised up a prodigious Height, and then it fell down so low, that he thought it had touched the Bottom of the Sea, and concluded himself lost: During this uncommon Motion he affirms to have heard one of these Noises resembling the

the firing a Cannon, and afterwards felt no Storm. I give it neither for true or false, but as a Relation of others. It is assured me by many, that on the Ninth Hour of the 10th Day, there was a small Shock of an Earthquake. These are all the Observations I have been able to make myself, and gather from other creditable Persons, having avoided the additional Stories that are commonly raised on such Occasions.

What has much attributed to the Preservation of this City, is the fatherly Care and Solitude of our Royal Sovereign, who, by the Means of his Royal Council of Regency, neither has or will ever fail giving us Instances of his Royal Munificence to this afflicted City; having ordered, that such Wood, Iron, &c. should be furnished as may be necessary for Repairs, with certain fixed Prices; having further ordered one half of the Duty to be taken off of Flesh. He has also, at his own Expence, sent a most able Engineer, and two Master-builders, to estimate and supervise the said Repairs: Neither has his Bounty failed to the more Indigent, who not having wherewithal to repair the Damages they have suffered by this Earthquake, he has ordered Money to be distributed for repairing them, that he may again see this his dear City vested in its former Beauty. The Assistance and Watchfulness of the Civil and Military Power was likewise very great, even during the time of the Earthquake; for by their means there were no Disorders practised, not even in the midst of the Hurry and Confusion, as it very commonly happens upon such Occasions.

You may always command me, and I am intirely at your Service, but hope never to obey you in such

a disagreeable Relation as the present. Wish me well, as I do you. *Adieu.*

Leghorn, Feb. 13. 1742.

P O S T S C R I P T.

I cannot omit to acquaint you with some Observations communicated to me after the writing of this Letter, by Sig. *Ferdinando Tidi*, a Gentleman of incontestable Credit, who being at his Seat in the Country, called *Popogna*, pretty high up a Hill, between the Mountain *Montenero* and the Valley *Benedetto*, on the 20th of *January*, about Two Hours and an half in the Night, he observed a large Circuit of Air in the West, (quite from the Island of *Corfica* to *Capo Mele*) thickened with Clouds, but open, and all the Remainder of the Sky covered with heavy dark Clouds; he saw the Air light, and extremely shining, so that one might easily read a Book; and, according to his Description, must have been a very bright *Aurora Borealis*. Besides this, he observed that when we had the Wind from South or East, the Sea was in great Agitation, and ran towards *Leghorn*, but suddenly retired. I will likewise tell you, that Sig. *Guiseppo Vincenti*, Captain of the first *Lazaretto*, and present *Canfaloniere* of the City, a Person not easily to be imposed upon, having one Night, at about Three Hours, opened his Window, saw a Cloud in the West, which was exceeding dark, except in the Middle, where a strong Light (like the Influence of the Sun just before its Rise) discovered itself, and dispersed Beams of reddish Fire all over the Circumference of the Cloud, which was very extensive. He made a Friend of his observe the same thing, but

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neither one or the other remember what Night it happened; and being uncertain of the particular Night, is the Reason I omitted it in the Account: But since it happens, that I am treating of these *Phænomenons*, which may have some Relation to the Earthquake, and proceed from the same first Cause, I imagine it must have been the same Night, though perhaps not. However it may have been, I have related to you a true Exposition of all things as they really were; and there is now a way opened for Philosophical Observations and Inquiries. As for me, I should be of Opinion, that it is a Collection of those Vapours and Exhalations proceeding from the Fermentation or Lighting of those Particles of Matter, which occasioned the Earthquake; but should be obliged to you for your Sentiments on it, having a great Regard to your Opinion. I remain as above.

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N. B. N^o 456. of these *Transactions* is ready to be published in a few Days, and the Gap between that and N^o 462. will be filled up with all possible Speed, the Papers being ready for the Press.