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THE LEANING TOWER OF PISA

比萨斜塔

—— 她800年的命运和历险故事 ——

人民教育出版社

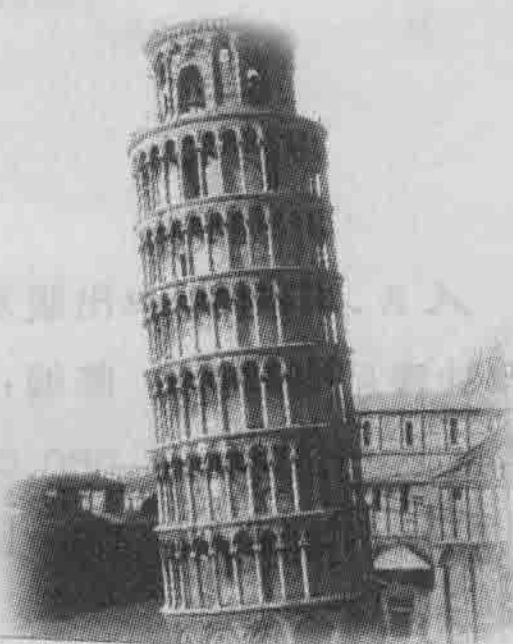
自然英语

Discovery

听读系列

比萨斜塔

人民教育出版社综合编辑室 策划
北京京文多媒体教育有限公司



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编者 2002 年 10 月

THE LEANING TOWER OF PISA

It's a marble masterpiece, one of the most famous buildings in the world. The Leaning Tower of Pisa is simply an impossibility. More like something you dream than something that can exist. For hundreds of years, the world has watched in amazement as the building defies gravity, teetering on a razor's edge.



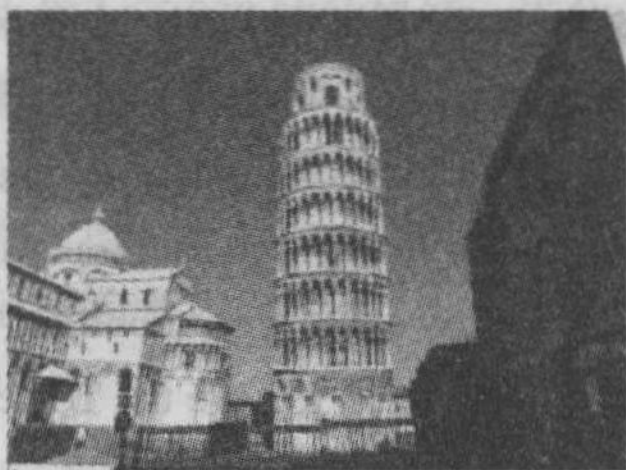
"It really is quite miraculous that it has not fallen over. And thank goodness it hasn't."

If the Tower were to fall no one would feel it more than the people of Pisa. For them the Tower is the heart of their city. It is what draws hundreds of thousands of tourists every year, each one anxious to give a helping hand. It really needs. The Leaning Tower of Pisa can tumble in an instant. For 800 years architects and engineers have been trying to fix the Leaning Tower of Pisa. Nearly every attempt has been disastrous. But somehow the Tower has serenely survived. Today the Tower is

比萨斜塔

这是用大理石建成的杰作，是世界上最著名的建筑之一。比萨斜塔简直令人难以置信，它就像梦中见到的东西，现实中根本不可能存在。几百年来，全世界都惊异地注视着它对重力的公然挑战，在危机四伏中摇摇欲坠。

“这塔没有倒，真是个奇迹。我们真应该感谢上帝。”



如果塔真的倒了，感触最多的一定是比萨的市民。对他们来说，这塔是他们城市的心脏，每年都吸引成千上万的游人来观看。每个人都十分希望能帮上忙，斜塔也确实需要帮助，因为它时刻都有坍塌的可能。800多年来，建筑师和工程师们一直在努力修正比萨斜塔，但几乎每一次尝试都损失惨重，好在比萨斜塔安然无恙。如今，比萨斜塔

in greater danger than ever. Its lean is so extreme that the Italian government has closed it to avoid a potential disaster. It have been more than ten years since anyone has walked up its marble stairway, which leads to its stunning bell chamber, until now. We will take a behind the scenes look inside the Tower that has been locked off to the public for so long and climb to the top for a rare view of its breathtaking vistas. We will examine the bizarre history of the 800 years effort to save the Tower and introduce the current plan that some believe just may make the Tower safe forever, that is if it doesn't destroy it first.

Today, the Tower is in crisis, a patient in intensive care. 830 tons of lead have been added to hold down its north side. Steel bands cinch its waist. 340-foot long cables are wrapped around it to prevent an impending catastrophe, while a group of international experts struggle to find a permanent solution.

Michele Jamiolkowski, a geo-technical engineer is the chairman of the current team to save the Tower.



的处境比以往更加危险。它倾斜得太厉害了，为了避免可能的灾难，意大利政府不得不关闭了它。到目前为止，已经有十几年没有人能够沿着它的大理石台阶登上去，参观那令人叹为观止的钟室了。我们将介绍一些长期以来一直向公众封锁的有关斜塔的幕后消息，并带领大家登上斜塔，一览壮观的美景。我们还将向大家介绍一下 800 多年来对斜塔进行的各种各样的拯救工作，以及目前一些人认为可以永久保证斜塔安全的方案。当然，前提是这些措施不会对斜塔造成危害。

目前，斜塔正处于危险阶段，像一个需要特别护理的病人。塔的北边加上了 830 吨的铅锤；塔的中部用钢带捆扎着。塔上共缠了 340 英尺长的钢缆以阻止即将发生的大灾祸。同时，众多国际专家也在努力寻找永久的解决方案。

米歇尔·珈米奥考斯基是一位地质技术工程师，他现任拯救斜塔小组的主席。



"This is not an easy task. Not only me, but ...

... all the other members of the committee became acquainted with the responsibility and with the risk which we are incurring with this task."

Their goal is to reduce the Tower to lean by about 16 inches. This would take the Tower out of danger, but keep it looking the same. After all, no one wants a straight Tower of Pisa.

"We never considered straightening the Tower, because ...

... the inclination is part of its character. It is absolutely central to Pisa. So there are two unacceptable scenarios really, aren't there? One would be a straight Tower, but the other one would be one that fell over."

The common perception is that the Tower is in danger of tipping over. In fact, that is only one of two perils that could reduce it to rubble.

"One problem is the very well known continuous increase of inclination, which was ...

... bringing the Tower to falling over."

“这可不是一件容易的事，并不只是对我而言……

……委员会的其他所有成员也对这次任务中所承担的责任和风险逐渐有了些了解。”

他们的目标是将斜塔的倾斜度减少，使塔身与垂线的偏离减少16英寸，这样既可以消除危险，还能保持它现有的倾斜外观。不管怎么说，大家都不想看到一个直立的比萨塔。

“我们从来没有想过把塔弄正，因为……

……倾斜的外观就是塔的一大特色，这对比萨来说是至关重要的。所以有两种情况是无法接受的，是吧？一种是把塔校正，另一种就是看着斜塔倒掉。”

一般都认为塔身有翻倒的危险，实际上，这只是斜塔坍塌的两个危险中的一个。

“一个众所周知的问题就是塔的斜度在不断增加，而这种增加……

……会使斜塔翻倒。



“And the second problem was the concern about the structural collapse.”

The first problem, the Tower is increasing slant due to the soft soil it is built on.

Professor Carlo Viggiani is a member of the committee to save the Tower. He has been studying the Tower for over 35 years.

“The leaning was by chance. Probably because on the south side of the Tower the subsoil was weaker than the north side.”

“So, and once it started to lean from that side, then the weight is going on that side and the thing is continuously increasing.”

By 1990, the Tower was leaning at an astounding five and a half degrees, or 17 feet off the perpendicular. It literally defies the laws of physics.

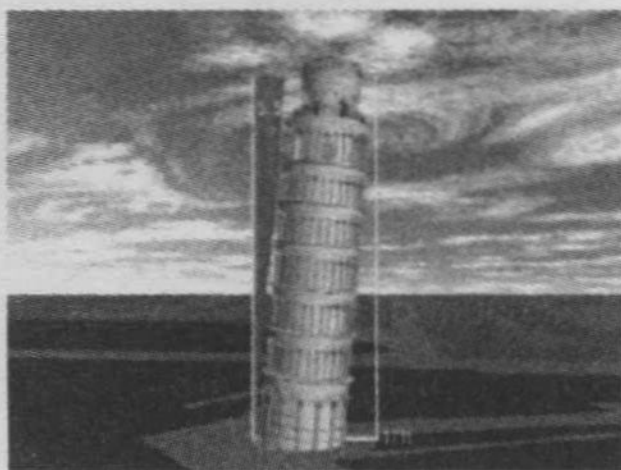
Committee member John Burland is a professor of soil mechanics.

“I think it is miraculous.

I mean, when we came here in 1990, we couldn't get it to stand up on our computer.

It is leaning at 5.5 degrees. We could only get our computer Tower to lean at 5.44 degrees and then it used to fall over. So it really is quite miraculous that it has not fallen over.”

The Tower isn't just in danger of falling, it can collapse under its own weight. Part of the problem stems from its structure.



“另一个问题就是结构坍塌。”

第一个问题（斜度增加）是由于塔建在松软的泥土上。

卡罗·维吉阿尼教授是拯救斜塔委员会的成员之一，他研究斜塔 35 年多了。

“倾斜是逐渐形成的，这可能是由于斜塔南侧的下层土质不如北侧坚硬。”

“所以，一旦塔开始从那一侧倾斜，重心就向那一侧偏移，然后情况就不断恶化。”

到 1990 年为止，斜塔的倾斜角度达到了 5.5 度，偏离垂线 17 英尺，令人吃惊。这简直是公然与物理定律叫板。

委员会成员之一，约翰·伯尔兰德是一位土壤力学教授。

“我认为这简直是不可思议。

我是说，我们 1990 年来到这儿，那时根本无法通过电脑模拟使如此倾斜的塔直立不倒。

塔的倾斜度是 5.5 度，而我们只能让电脑上的模型倾斜到 5.44 度，再倾斜一点塔就会倒塌。所以这塔至今还没倒真是奇迹。”

斜塔面临的危机并不只是倾斜，还有可能由于不堪其自身的重量而倒塌，这个问题的部分原因可能在于塔的结构。

Although the Tower appears solid, it is actually a hollow cylinder reaching 185 feet into the sky. Within it, a staircase winds up to the top. Most of its 14,000 tons are supported by its walls. Its walls, however, aren't solid either. They are stone, lime and mortar, covered with a thin marble facade.

"One side ...

... with all of the stone is getting a lot of pressure. The other side with all of its stone is not getting that pressure, so there is an inequality."

As the Tower's lean continues, the pressure intensifies. Eventually the marble in this second floor section will give way; the building will collapse upon itself.

"It could explode at any time, or this was the case in 1990 anyway.

So we've got a Tower that is just about to fall over and it is on the point of exploding. And that makes it probably the biggest civil engineering challenge there is."

Solving the challenge of the Tower has stumped generations of engineers. Its problems began almost as soon as it was built.

When plans for the Tower were first drawn up in the 12th Century, a spot was chosen with a commanding view of Pisa. It was beautiful.

But not a very good place to build, since in ancient Italy, the site had been a lagoon.

Piero Pierotti, is an art historian and professor of medieval architecture at the University of Pisa.

"Pisa was a system of islands in the middle of a very wide lagoon.

这塔看起来很坚固，但它实际上只是一个高度达185英尺的空心圆柱体。在塔的内部，有一个阶梯蜿蜒而上。14 000吨的重量大都由墙壁支撑着，但斜塔的墙壁也并不坚固，是由石头、石灰和灰泥建成的，上面覆盖了一层薄的大理石面。

“一侧……

……的石墙承受着巨大的压力，而另一侧的石墙承受的压力相对较轻，所以受力很不均衡。”

随着塔身继续倾斜，压力也越来越大。最后，第二层的大理石将不堪重压而垮塌，整个斜塔也将随之坍塌。

“它任何时候都有可能发生垮塌，至少1990年那次就是这个情况。

所以，斜塔现在的情况是即将翻倒，而且处在坍塌的边缘，这恐怕是对市政工程最大的挑战了。”

拯救斜塔使几代工程师绞尽了脑汁。其实，早在斜塔建造之初就埋下了这个隐患。

12世纪制定斜塔建造方案时，选取了一个能将比萨市一览无余的修建地点，那里非常美丽。

但这里并不适合筑房建塔，因为在意大利的远古时期，这里曾经是一个泻湖。

皮埃罗·皮埃罗蒂是一位艺术史学家，还是比萨大学的中世纪建筑学教授。

“比萨是由一个非常宽阔的泻湖中间的一系列岛屿组成的。

This lagoon was slowly filled in by the two most important Tuscan rivers, the Arno and the Auser.

And where the rivers had filled in, they left mud, which is softer and wet.”

The soft wet soil left behind was where the Tower was built.

“The ground is so soft that it is really like building a brick Tower on a soft carpet. You can go to a certain height, and no matter how straight you try and keep that Tower, it will start to lean and then fall over.”

Why build a Tower doomed to lean? Although the medieval architects knew that the soil was soft, they may not have known how soft. They thought they had found the perfect spot to build a monument to the glory of Pisa.

Today, Pisa is a quiet university town of 100 000.



In the 11th Century, it was a powerful city-state. Its navy roved the seas, conquering other cities. In 1062, the Pisa navy sailed to Palermo, the capital of Sicily, bent on conquest.