

美国最权威的研究性学习教材

SCIENCE EXPLORER

科学 探索者

地球上的水

浙江教育出版社



Prentice
Hall

▲ 上 海 市

A photograph of a waterfall cascading over rocks in a forest. The water is white and frothy as it falls, creating a misty spray at the bottom. The surrounding trees are dark and dense, with some green foliage visible in the mid-ground. The lighting is soft, suggesting an overcast day or a shaded forest interior.

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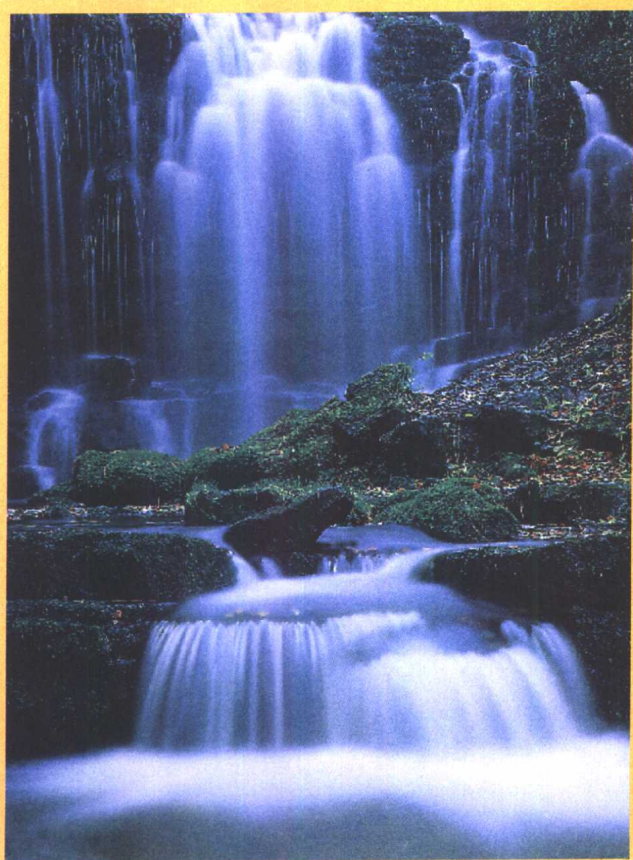
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Annotated Teacher's Edition
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Earth's Waters Materials Kits

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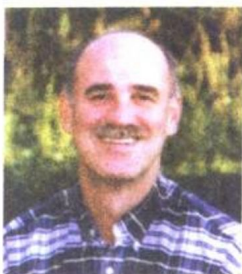
封面：这是英格兰约克郡北部的一个瀑布，它生动地表现了流动中的水的力量和美态。

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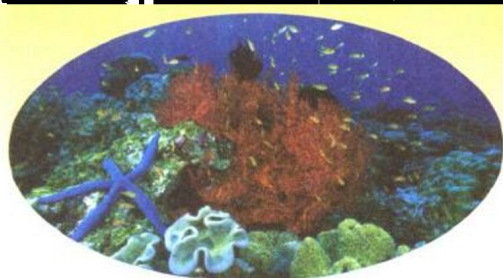
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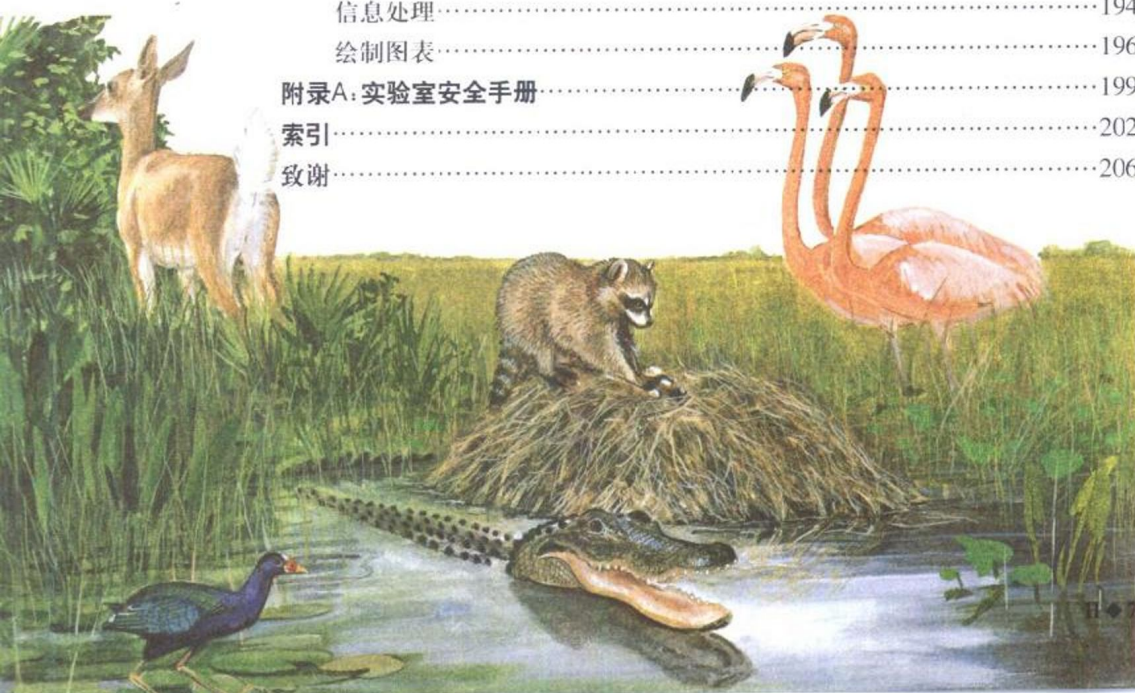




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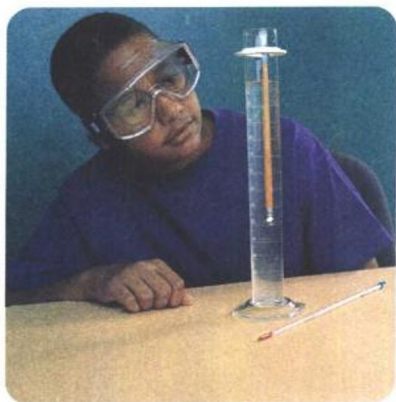
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黑暗世界 里的 生命

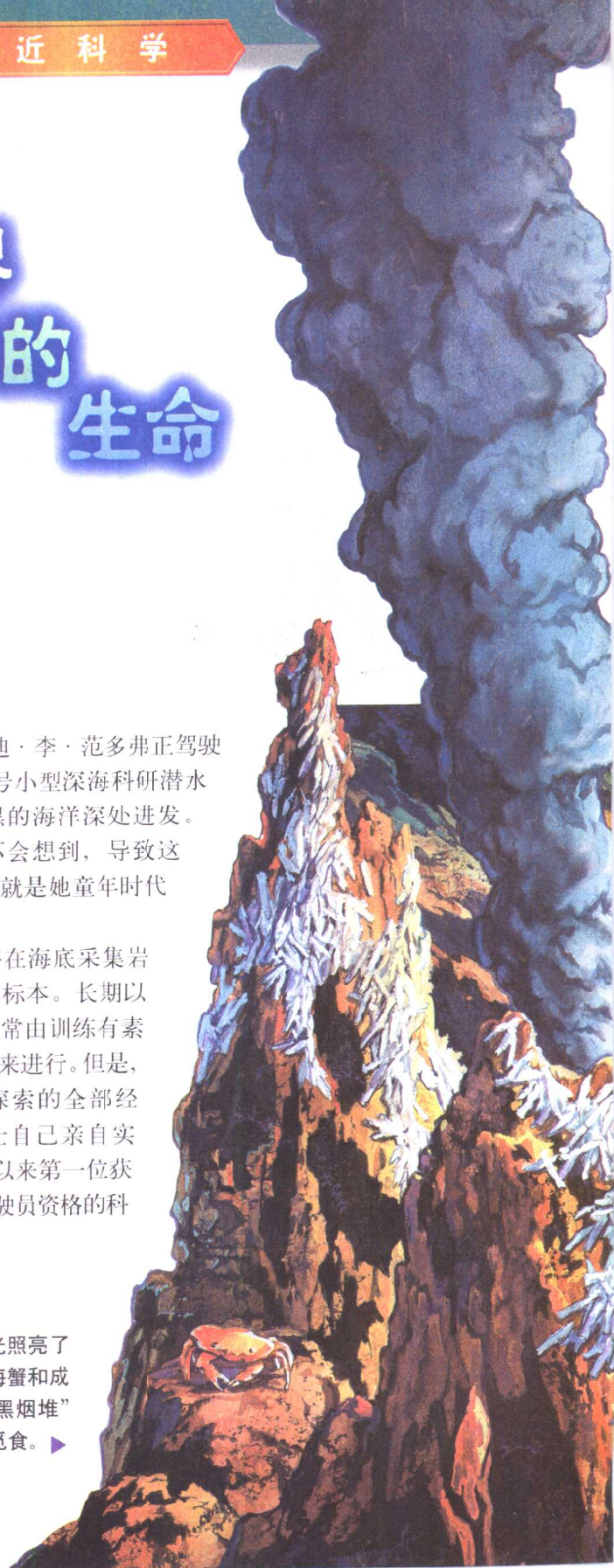


辛迪·李·范多弗生于美国新泽西州伊通镇，并在那里长大。她对海底虾类的研究始于在麻省理工学院读研究生时。她曾在麻省伍兹霍尔海洋研究所当过研究员。现在是美国西海岸国家海底研究所科学所长，该研究所位于费尔班克斯的阿拉斯加大学。

海洋学家辛迪·李·范多弗正驾驶着阿尔文号小型深海科研潜水器向冰冷、漆黑的海洋深处进发。她自己怎么也不会想到，导致这一切的原因其实就是她童年时代的好奇。

阿尔文号将在海底采集岩石和珍稀动物的标本。长期以来，这类工作通常由训练有素的潜水器驾驶员来进行。但是，为了掌握海洋探索的全部经验，范多弗博士自己亲自实践，就成了有史以来第一位获得深海潜水器驾驶员资格的科学家。

阿尔文号潜水器的灯光照亮了漆黑的海底，那里有海蟹和成群的海虾在被称为“黑烟堆”的洋底热流出口周围觅食。▶

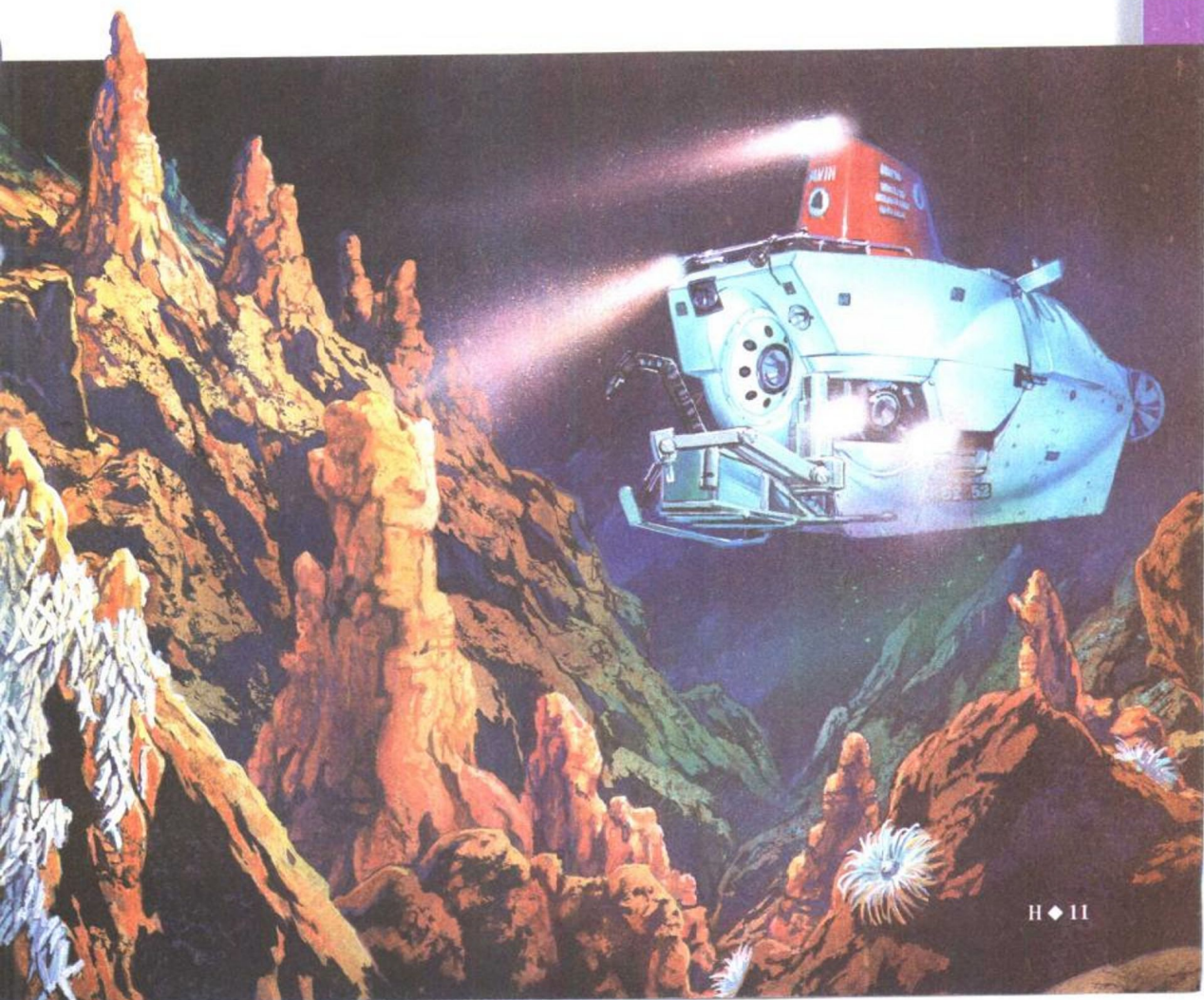


海底的生命

大西洋深深的底部是地球上一块没有阳光、充满奥秘和远不可及的地方。阿尔文号潜水器慢慢地下潜到了海底，靠近了一道海岭。范多弗博士看到了簇拥在一股被称为“黑烟堆”的洋底热流出口周围的成群动物。当然，这些“黑烟”并不是真正的烟雾，它们是从大洋底部裂缝中冲出的一股股携带着大量矿物质的高温水流。一些微生物以这些矿物质为养料。范多弗博士感兴趣的是那些吞食这类微生物的、极不寻常的小虾。



▲“黑烟堆”涌出口的热水炽热得能发出微光。从那里涌出来的水，温度高达 350°C 。当这些滚烫的水和冰凉的海水混合时，它的温度就很快降了下来。



提不完的问题

范多弗博士从小就对自然界的每一件事物充满了好奇。她说：“我先是对甲壳虫感兴趣，后来迷上了青蛙和蝌蚪，接着是花卉和树木，随后就是鸟类。但我真正感兴趣的是海洋无脊椎动物，即那些没有脊梁骨的海洋动物。”“它们是那样的奇异。我特别喜欢它们奇特的生理构造。甲壳虫类为什么会有十条腿，或者更多的腿？它那么多的腿用来干什么？”

这些小虾有眼睛吗？

范多弗博士一面驾驶着阿尔文号潜水器，一面想着她要观察的小虾。她知道，这些小虾生长在大洋底部的黑暗中，它们没有其他虾类常有的黑亮如小珠般的眼睛和眼柄。她也知道，在

阳光无法到达的海洋深部，没有眼睛的动物是很普遍的。但是，范多弗博士在实验室里对小虾背上闪亮的奇特斑点的观察，使她获得了极有趣的发现。

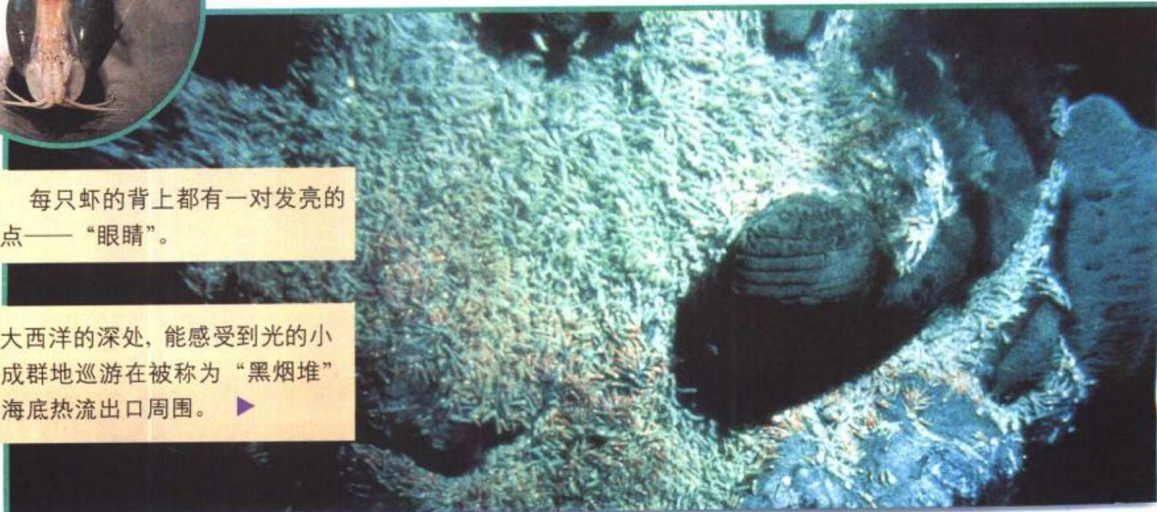
“其他同事认为我是想入非非。在没有光线的海洋深处，它们要眼睛有什么用？”

她想知道这些斑点有什么用。“我在实验室里解剖了一只虾，在斑点下面，我找到了一对组织，并将它们剥离出来。这对组织很容易发现。但令我吃惊的是它们和虾的大脑联结在一起。



▲ 每只虾的背上都有一对发亮的斑点——“眼睛”。

在大西洋的深处，能感受到光的小虾成群地巡游在被称为“黑烟堆”的海底热流出口周围。 ▶



我观察它们，不由得说出声来：“看，这就是一只眼睛！”其他同事认为我是想入非非。在没有光线的海洋深处，它们的眼睛有什么用？”

范多弗博士的思维是开放的。她向一些研究甲壳虫类眼睛的专家展示了她的发现。专家们认定，这不仅是一只眼睛，而且是一只能辨认出极其微弱光线的奇特的眼睛。这一答案立即导致了另一个问题：小虾在海底能看到什么？

“我们考虑了种种可能，”范多弗博士说，“可以确定的事实是这些虾只生活在那些高温的热流出口附近，我们也知道炙热的物体能发光。那么那些涌出热流的海底豁口会发光吗？答案是肯定的。这些奇特的眼睛就是用来辨认海底的高温区域。”科学家假设：小虾的眼睛引导它们游向有微弱光线的地方，在那儿，它们可以找到赖以生存的微生物；而当小虾游近海底豁口时，光线就会逐渐增强。这些光线能够提醒小虾不要和刚从海底豁口涌出来的热水流靠得太近。

瞻望未来

如今，范多弗博士常常考虑让科学家们用深海潜水器在欧洲水域进行考察的计划。科学家们将在控制室里操纵一台机器人潜水器，让它在欧洲的海底游弋。“我的年龄还能使我看到这一切的发生。”范多弗博士说。当有人问她是否愿意成为这些科学家中的一员时，她毫不犹豫地笑着说：“那可太美妙了！”



▲ 海上作业船正在将完成深海考察的阿尔文号潜水器起吊上船。

阅读 DIY

辛迪·李·范多弗的发现来自于她对事物细微处的观察和对发现的现象不断提出问题。想一想，根据记忆来描述并记录一个你常去并熟悉的室外地点的情况。然后重访该地，进行观察并记下各种新的问题。

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